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# Foreword

This Technical Specification (TS) has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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- x the first digit:
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- z the third digit is incremented when editorial only changes have been incorporated in the document.

## 1 Scope

. The present document establishes the minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE).

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain"
- [3] ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".
- [4] 3GPP TS 36.211: "Physical Channels and Modulation".
- [5] 3GPP TS 36.212: "Multiplexing and channel coding".
- [6] 3GPP TS 36.213: "Physical layer procedures".
- [7] 3GPP TS 36.331: " Requirements for support of radio resource management ".
- [8] 3GPP TS 36.307: " Requirements on User Equipments (UEs) supporting a release-independent frequency band".
- [9] 3GPP TS 36.423: "X2 application protocol (X2AP) ".

# 3 Definitions, symbols and abbreviations

#### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply in the case of a single component carrier. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Aggregated Channel Bandwidth: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

Aggregated Transmission Bandwidth Configuration: The number of resource block allocated within the aggregated channel bandwidth.

**Carrier aggregation:** Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band:** A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

**Carrier aggregation bandwidth class:** A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

**Carrier aggregation configuration**: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

Channel edge: The lowest and highest frequency of the carrier, separated by the channel bandwidth.

**Channel bandwidth:** The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

**Contiguous carriers:** A set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

**Contiguous resource allocation:** A resource allocation of consecutive resource blocks within one carrier or across contiguously aggregated carriers. The gap between contiguously aggregated carriers due to the nominal channel spacing is allowed.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

Enhanced performance requirements type A: This defines performance requirements assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

Intra-band contiguous carrier aggregation: Contiguous carriers aggregated in the same operating band.

Intra-band non-contiguous carrier aggregation: Non-contiguous carriers aggregated in the same operating band.

**Lower** sub-block **edge:** The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

**Sub-block:** This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

**Sub-block gap:** A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Synchronized operation: Operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

**Unsynchronized operation:** Operation of TDD in two different systems, where the conditions for synchronized operation are not met.

**Upper sub-block edge:** The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

BW <sub>Channel</sub>	Channel bandwidth
BW <sub>Channel,block</sub>	Sub-block bandwidth, expressed in MHz. BW <sub>Channel,block</sub> = F <sub>edge,block,high</sub> - F <sub>edge,block,low</sub> .
BW <sub>Channel_CA</sub>	Aggregated channel bandwidth, expressed in MHz.
$BW_{GB}$	Virtual guard band to facilitate transmitter (receiver) filtering above / below edge CCs.

$E_{RS}$	Transmitted energy per RE for reference symbols during the useful part of the symbol, i.e.
	excluding the cyclic prefix, (average power normalized to the subcarrier spacing) at the eNode B transmit antenna connector
$\hat{E}_s$	The averaged received energy per RE of the wanted signal during the useful part of the symbol,
	i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical channels (including user specific RSs when present), divided by the number of REs within the set, and normalized to the subcarrier spacing
F F	Frequency
$F_{Interferer}$ (offset) $F_{Interferer}$	Frequency offset of the interferer Frequency of the interferer
F <sub>C</sub>	Frequency of the carrier centre frequency
F <sub>C,block, high</sub>	Center frequency of the highest transmitted/received carrier in a sub-block.
F <sub>C,block, low</sub>	Center frequency of the lowest transmitted/received carrier in a sub-block.
F <sub>C_low</sub>	The centre frequency of the lowest carrier, expressed in MHz.
F <sub>C_high</sub>	The centre frequency of the <i>highest carrier</i> , expressed in MHz.
F <sub>DL_low</sub>	The lowest frequency of the downlink operating band
F <sub>DL_high</sub>	The highest frequency of the downlink operating band
F <sub>UL_low</sub> F <sub>UL_high</sub>	The lowest frequency of the uplink operating band The highest frequency of the uplink operating band
$F_{edge,block,low}$	The lower sub-block edge, where $F_{edge,block,low} = F_{C,block,low} - F_{offset}$ .
$F_{edge,block,high}$	The upper sub-block edge, where $F_{edge,block,high} = F_{C,block,high} + F_{offset.}$
F <sub>edge_low</sub>	The <i>lower edge</i> of aggregated channel bandwidth, expressed in MHz.
F <sub>edge_high</sub>	The higher edge of aggregated channel bandwidth, expressed in MHz.
F <sub>offset</sub>	Frequency offset from $F_{C_{high}}$ to the <i>higher edge</i> or $F_{C_{low}}$ to the <i>lower edge</i> .
Foffset, block, low	Separation between lower edge of a sub-block and the center of the lowest component carrier within the sub-block
$F_{offset,block,high}$	Separation between higher edge of a sub-block and the center of the highest component carrier within the sub-block
F <sub>offset_NS_23</sub> F <sub>OOB</sub>	Frequency offset in MHz needed if NS_23 is used The boundary between the E-UTRA out of band emission and spurious emission domains.
$I_o$	The power spectral density of the total input signal (power averaged over the useful part of the
	symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal
I <sub>or</sub>	The total transmitted power spectral density of the own-cell downlink signal (power averaged over
	the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the eNode B transmit antenna connector
$\hat{I}_{or}$	The total received power spectral density of the own-cell downlink signal (power averaged over
	the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector
$I_{ot}$	The received power spectral density of the total noise and interference for a certain RE (average
	power obtained within the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector
L <sub>CRB</sub>	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks
N <sub>cp</sub>	Cyclic prefix length
N <sub>DL</sub>	Downlink EARFCN
$N_{oc}$	The power spectral density of a white noise source (average power per RE normalised to the
	subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector
N <sub>oc1</sub>	The power spectral density of a white noise source (average power per RE normalized to the
	subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that are not defined in a test procedure, as measured at the UE antenna connector.

N	The power spectral density of a white noise source (average power per RE normalized to the
$N_{oc2}$	
	subcarrier spacing), simulating interference in CRS symbols in ABS subframe from all cells that are not defined in a test procedure, as measured at the UE antenna connector.
3.7	•
$N_{oc3}$	The power spectral density of a white noise source (average power per RE normalised to the
	subcarrier spacing), simulating interference in non-ABS subframe from cells that are not defined
	in a test procedure, as measured at the UE antenna connector
$N_{oc}$	The power spectral density (average power per RE normalised to the subcarrier spacing) of the
	summation of the received power spectral densities of the strongest interfering cells explicitly
	defined in a test procedure plus $N_{oc}$ , as measured at the UE antenna connector. The respective
	power spectral density of each interfering cell relative to $N_{oc}$ is defined by its associated DIP
	value.
N <sub>Offs-DL</sub>	Offset used for calculating downlink EARFCN
N <sub>Offs-UL</sub>	Offset used for calculating uplink EARFCN
$N_{otx}$	The power spectral density of a white noise source (average power per RE normalised to the
	subcarrier spacing) simulating eNode B transmitter impairments as measured at the eNode B
	transmit antenna connector
N <sub>RB</sub>	Transmission bandwidth configuration, expressed in units of resource blocks
N <sub>RB_agg</sub>	The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth.
$N_{RB\_alloc}$	Total number of simultaneously transmitted resource blocks in Channel bandwidth or Aggregated
N	Channel Bandwidth.
$N_{RB,c}$	The transmission bandwidth configuration of component carrier <i>c</i> , expressed in units of resource
N	blocks The largest transmission bandwidth configuration of the component carriers in the bandwidth
N <sub>RB,largest BW</sub>	combination, expressed in units of resource blocks
N <sub>UL</sub>	Uplink EARFCN.
Rav	Minimum average throughput per RB.
P <sub>CMAX</sub>	The configured maximum UE output power.
$P_{CMAX}, c$	The configured maximum UE output power for serving cell c.
P <sub>EMAX</sub>	Maximum allowed UE output power signalled by higher layers. Same as IE <i>P-Max</i> , defined in [7].
P <sub>EMAX, c</sub>	Maximum allowed UE output power signalled by higher layers for serving cell c. Same as IE
	<i>P-Max</i> , defined in [7].
PInterferer	Modulated mean power of the interferer
P <sub>PowerClass</sub>	P <sub>PowerClass</sub> is the nominal UE power (i.e., no tolerance).
P <sub>UMAX</sub>	The measured configured maximum UE output power.
Puw	Power of an unwanted DL signal
Pw	Power of a wanted DL signal
RB <sub>start</sub>	Indicates the lowest RB index of transmitted resource blocks.
RB <sub>end</sub>	Indicates the highest RB index of transmitted resource blocks.
$\Delta f_{OOB} \Delta R_{IB,c}$	$\Delta$ Frequency of Out Of Band emission. Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving
ΔINIB,c	cell c.
$\Delta T_{\mathrm{IB,c}}$	Allowed maximum configured output power relaxation due to support for inter-band CA
⊥ IB,c	operation, for serving cell c.
$\Delta T_{\rm C}$	Allowed operating band edge transmission power relaxation.
$\Delta T_{C,c}$	Allowed operating band edge transmission power relaxation.
σ	Test specific auxiliary variable used for the purpose of downlink power allocation, defined in
-	Annex C.3.2.
$W_{gap}$	Sub-block gap size
5"r	

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ABS	Almost Blank Subframe
ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity

A-MPR	Additional Maximum Power Reduction
AWGN	Additive White Gaussian Noise
BS	Base Station
CA	Carrier Aggregation
CA_X	CA for band X where X is the applicable E-UTRA operating band
CA_X-X	Non-contiguous intra band CA for band X where X is the applicable E-UTRA operating band
CA_X-Y	CA for band X and Band Y where X and Y are the applicable E-UTRA operating band
CC	Component Carriers
CPE	Customer Premise Equipment
CPE_X	Customer Premise Equipment for E-UTRA operating band X
CW	Continuous Wave
DL	Downlink
DIP	Dominant Interferer Proportion
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EPRE	Energy Per Resource Element
E-UTRA	Evolved UMTS Terrestrial Radio Access
EUTRAN	Evolved UMTS Terrestrial Radio Access Network
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
FRC	Fixed Reference Channel
HD-FDD	Half- Duplex FDD
MCS	Modulation and Coding Scheme
MOP	Maximum Output Power
MPR	Maximum Power Reduction
MSD	Maximum Sensitivity Degradation
OCNG	OFDMA Channel Noise Generator
OFDMA	Orthogonal Frequency Division Multiple Access
OOB	Out-of-band
PA	Power Amplifier
PCC	Primary Component Carrier
P-MPR	Power Management Maximum Power Reduction
PSS	Primary Synchronization Signal
PSS_RA	PSS-to-RS EPRE ratio for the channel PSS
RE	Resource Element
REFSENS	Reference Sensitivity power level
r.m.s	Root Mean Square
SCC	Secondary Component Carrier
SINR	Signal-to-Interference-and-Noise Ratio
SNR	Signal-to-Noise Ratio
SSS	Secondary Synchronization Signal
SSS_RA	SSS-to-RS EPRE ratio for the channel SSS
TDD	Time Division Duplex
UE UL	User Equipment
UL-MIMO	Uplink Up Link Multiple Antonno transmission
	Up Link Multiple Antenna transmission Universal Mobile Telecommunications System
UMTS UTRA	Universal Mobile Telecommunications System UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
xCH_RA	xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS
xCH_RB	xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS
ACH_RD	NOT TO NO LI KE TUTO TOT THE CHAINEL NOT IN AN UMISINITED OF DIVESYMBOLS CONTAINING KS

## 4 General

# 4.1 Relationship between minimum requirements and test requirements

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 36.521-1 Annex F defines Test Tolerances. These Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum Requirements in this specification to create Test Requirements.

The measurement results returned by the Test System are compared - without any modification - against the Test Requirements as defined by the shared risk principle.

The Shared Risk principle is defined in ITU-R M.1545 [3].

## 4.2 Applicability of minimum requirements

- a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios
- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The reference sensitivity power levels defined in subclause 7.3 are valid for the specified reference measurement channels.
- d) Note: Receiver sensitivity degradation may occur when:
  - 1) The UE simultaneously transmits and receives with bandwidth allocations less than the transmission bandwidth configuration (see Figure 5.6-1), and
  - 2) Any part of the downlink transmission bandwidth is within an uplink transmission bandwidth from the downlink center subcarrier.
- e) The spurious emissions power requirements are for the long term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.

## 4.3 Void

# 4.3A Applicability of minimum requirements (CA, UL-MIMO)

The requirements in clauses 5, 6 and 7 which are specific to CA and UL-MIMO are specified as suffix A, B, C, D where;

- a) Suffix A additional requirements need to support CA
- b) Suffix B additional requirements need to support UL-MIMO
- c) Suffix C additional requirements need to support TBD
- d) Suffix D additional requirements need to support TBD

A terminal which supports the above features needs to meet both the general requirements and the additional requirement applicable to the additional subclause (suffix A, B, C and D) in clauses 5, 6 and 7. Where there is a difference in requirement between the general requirements and the additional subclause requirements (suffix A, B, C and D) in clauses 5, 6 and 7, the tighter requirements are applicable unless stated otherwise in the additional subclause.

A terminal which supports more than one feature (CA and UL-MIMO) in clauses 5, 6 and 7 shall meet all of the separate corresponding requirements.

For a terminal supporting CA, compliance with minimum requirements for non-contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for contiguous intraband carrier aggregation in the same operating band.

For a terminal supporting CA, compliance with minimum requirements for contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for non- contiguous intra-band carrier aggregation in the same operating band.

A terminal which supports CA, for each supported CA configuration, shall support Pcell transmissions in each of the aggregated Component Carriers unless indicated otherwise in clause 5.6A.1.

## 4.4 RF requirements in later releases

The standardisation of new frequency bands and carrier aggregation configurations (downlink and uplink aggregation) may be independent of a release. However, in order to implement a UE that conforms to a particular release but supports a band of operation or a carrier aggregation configuration that is specified in a later release, it is necessary to specify some extra requirements. TS 36.307 [8] specifies requirements on UEs supporting a frequency band or a carrier aggregation configuration that is independent of release.

NOTE: For terminals conforming to the 3GPP release of the present document, some RF requirements in later releases may be mandatory independent of whether the UE supports the bands or carrier aggregation configurations specified in later releases or not. The set of requirements from later releases that is also mandatory for UEs conforming to the 3GPP release of the present document is determined by regional regulation.

# 5 Operating bands and channel arrangement

## 5.1 General

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

- NOTE: Other operating bands and channel bandwidths may be considered in future releases.
- 5.2 Void
- 5.3 Void
- 5.4 Void

## 5.5 Operating bands

E-UTRA is designed to operate in the operating bands defined in Table 5.5-1.

E-UTRA Operating Band	Uplink (UL) ope BS rece UE trans F <sub>UL_low</sub> –	eive smit	Downlink (DL) o BS tran UE rec F <sub>DL_low</sub> –	ismit eive	Duplex Mode
1	1920 MHz –	1980 MHz	2110 MHz –		FDD
2	1850 MHz –	1910 MHz	1930 MHz –		FDD
3	1710 MHz –	1785 MHz	1805 MHz –	1880 MHz	FDD
4	1710 MHz –	1755 MHz	2110 MHz –	2155 MHz	FDD
5	824 MHz –	849 MHz	869 MHz -	894MHz	FDD
6 <sup>1</sup>	830 MHz –	840 MHz	875 MHz –		FDD
7	2500 MHz –	2570 MHz	2620 MHz -		FDD
8	880 MHz -	915 MHz	925 MHz -	960 MHz	FDD
9	1749.9 MHz –	1784.9 MHz	1844.9 MHz –	1879.9 MHz	FDD
10	1710 MHz –	1770 MHz	2110 MHz –	2170 MHz	FDD
10	1427.9 MHz –	1447.9 MHz	1475.9 MHz –	1495.9 MHz	FDD
12	699 MHz –	716 MHz	729 MHz –		FDD
13	777 MHz –	787 MHz	729 MHZ –		FDD
14	788 MHz –	798 MHz	740 MHz –	768 MHz	FDD
14	Reserv		Reser		FDD
16	Reserv		Reser		FDD
17	704 MHz –	716 MHz	734 MHz –		FDD
18	815 MHz –	830 MHz	860 MHz -		FDD
19		845 MHz		890 MHz	FDD
20	830 MHz – 832 MHz –	862 MHz	875 MHz – 791 MHz –	821 MHz	FDD
20	1447.9 MHz –	1462.9 MHz	1495.9 MHz –	1510.9 MHz	FDD
21	3410 MHz –	3490 MHz	3510 MHz –		FDD
22	2000 MHz –	2020 MHz	2180 MHz –		FDD
23		1660.5 MHz			FDD
24		1915 MHz		1995 MHz	FDD
25	<u>1850 MHz</u> – 814 MHz –	849 MHz	1930 MHz – 859 MHz –	894 MHz	FDD
20	807 MHz –	824 MHz	852 MHz -	869 MHz	FDD
28	703 MHz –	748 MHz	758 MHz –		FDD
20	/03/MHZ =N/A				FDD <sup>2</sup>
	IN/A		717 MHz –	720 10112	FDD
33	1900 MHz –	1920 MHz	1900 MHz –	1920 MHz	TDD
34	2010 MHz –	2025 MHz	2010 MHz –	2025 MHz	TDD
35	1850 MHz –	1910 MHz	1850 MHz –		TDD
36	1930 MHz –	1990 MHz	1930 MHz –		TDD
37	1910 MHz –	1930 MHz	1910 MHz –	1930 MHz	TDD
38	2570 MHz –	2620 MHz	2570 MHz –	2620 MHz	TDD
39	1880 MHz –	1920 MHz	1880 MHz –	1920 MHz	TDD
40	2300 MHz –	2400 MHz	2300 MHz –	2400 MHz	TDD
41	2496 MHz	2690 MHz	2496 MHz	2690 MHz	TDD
42	3400 MHz –	3600 MHz	3400 MHz –	3600 MHz	TDD
43	3600 MHz –	3800 MHz	3600 MHz -	3800 MHz	TDD
44	703 MHz –	803 MHz	703 MHz –	803 MHz	TDD
	Band 6 is not applica		70310112 -		ייי
NOTE 2: F	Restricted to E-UTRA ownlink operating ba arrier aggregation co	A operation whe and is paired wi	th the uplink operati	ing band (externation	

Table 5.5-1 E-UTRA operating bands

# 5.5A Operating bands for CA

E-UTRA carrier aggregation is designed to operate in the operating bands defined in Tables 5.5A-1 and 5.5A-2.

E-UTRA	E-UTRA	Uplink (UL) operating band			Downlink (DL) operating band			Duplex Mode
CA Band	Band	BS receive	BS receive / UE transmit			BS transmit / UE receive		
		F <sub>UL_low</sub> – F <sub>UL_high</sub>			F <sub>DL_low</sub> – F <sub>DL_high</sub>			
CA_1	1	1920 MHz	-	1980 MHz	2110 MHz	Ι	2170 MHz	FDD
CA_7	7	2500 MHz	I	2570 MHz	2620 MHz	Ι	2690 MHz	FDD
CA_38	38	2570 MHz	١	2620 MHz	2570 MHz	Ι	2620 MHz	TDD
CA_40	40	2300 MHz	I	2400 MHz	2300 MHz	Ι	2400 MHz	TDD
CA_41	41	2496 MHz		2690 MHz	2496 MHz		2690 MHz	TDD

Table 5.5A-1: Intra-band contiguous CA operating bands

E-UTRA	E-UTRA	Uplink (UL)	оре	erating band	Downlink (D	L) c	perating band	Duplex
CA Band	Band	BS receive / UE transmit			BS transr	Mode		
		F <sub>UL_low</sub>	-	F <sub>UL_high</sub>			F <sub>DL_high</sub>	
0.4.5	1	1920 MHz	Ι	1980 MHz	2110 MHz	-	2170 MHz	
CA_1-5	5	824 MHz	-	849 MHz	869 MHz	Ι	894 MHz	FDD
CA_1-18	1	1920 MHz	-	1980 MHz	2110 MHz	I	2170 MHz	
	18	815 MHz	-	830 MHz	860 MHz	Ι	875 MHz	FDD
CA 1 10	1	1920 MHz	-	1980 MHz	2110 MHz	Ι	2170 MHz	
CA_1-19	19	830 MHz	Ι	845 MHz	875 MHz	I	890 MHz	FDD
CA 1 21	1	1920 MHz	I	1980 MHz	2110 MHz	Ι	2170 MHz	FDD
CA_1-21	21	1447.9 MHz	-	1462.9 MHz	1495.9 MHz	Ι	1510.9 MHz	
CA 2.17	2	1850 MHz	-	1910 MHz	1930 MHz	Ι	1990 MHz	
CA_2-17	17	704 MHz	-	716 MHz	734 MHz	I	746 MHz	FDD
CA 0.00	2	1850 MHz	-	1910 MHz	1930 MHz	I	1990 MHz	
CA_2-29	29		N/A		717 MHz	-	728 MHz	FDD
	3	1710 MHz	-	1785 MHz	1805 MHz	Ι	1880 MHz	
CA_3-5	5	824 MHz	-	849 MHz	869 MHz	I	894 MHz	FDD
CA 2.7	3	1710 MHz	-	1785 MHz	1805 MHz	I	1880 MHz	
CA_3-7	7	2500 MHz	-	2570 MHz	2620 MHz	Ι	2690 MHz	FDD
04.0.0	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	500
CA_3-8	8	880 MHz		915 MHz	925 MHz		960 MHz	FDD
<u></u>	3	1710 MHz	_	1785 MHz	1805 MHz	I	1880 MHz	500
CA_3-20	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	FDD
01.15	4	1710 MHz	-	1755 MHz	2110 MHz	Ι	2155 MHz	500
CA_4-5	5	824 MHz	-	849 MHz	869 MHz	I	894 MHz	FDD
01.17	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	500
CA_4-7	7	2500 MHz		2570 MHz	2620 MHz		2690 MHz	FDD
0.1.1.10	4	1710 MHz	-	1755 MHz	2110 MHz	-	2155 MHz	
CA_4-12	12	699 MHz	-	716 MHz	729 MHz	I	746 MHz	FDD
0.1.1.10	4	1710 MHz	_	1755 MHz	2110 MHz	I	2155 MHz	500
CA_4-13	13	777 MHz	-	787 MHz	746 MHz	-	756 MHz	FDD
o	4	1710 MHz	_	1755 MHz	2110 MHz	I	2155 MHz	
CA_4-17	17	704 MHz	-	716 MHz	734 MHz	-	746 MHz	FDD
<u></u>	4	1710 MHz	_	1755 MHz	2110 MHz	I	2155 MHz	
CA_4-29	29		N/A		717 MHz	I	728 MHz	FDD
04 5 40	5	824 MHz	_	849 MHz	869 MHz	I	894 MHz	500
CA_5-12	12	699 MHz	-	716 MHz	729 MHz	I	746 MHz	FDD
o	5	824 MHz	-	849 MHz	869 MHz	I	894 MHz	
CA_5-17	17	704 MHz	-	716 MHz	734 MHz	-	746 MHz	FDD
04 7 00	7	2500 MHz	_	2570 MHz	2620 MHz	-	2690 MHz	<b>FDD</b>
CA_7-20	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	FDD
04 0 00	8	880 MHz	_	915 MHz	925 MHz	-	960 MHz	
CA_8-20	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	FDD
0	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	-	1495.9 MHz	
CA_11-18	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD

#### Table 5.5A-2: Inter-band CA operating bands

E-UTRA	E-UTRA	Uplink (UL) operating band			Downlink (D	Duplex		
CA Band	Band	BS receive / UE transmit			BS transi	nit /	UE receive	Mode
		F <sub>UL_low</sub> – F <sub>UL_high</sub>			F <sub>DL_low</sub> – F <sub>DL_high</sub>			
CA_25-25	25	1850 MHz	-	1915 MHz	1930 MHz	-	1995 MHz	FDD
CA_41-41	41	2496 MHz	-	2690 MHz	2496 MHz	Ι	2690 MHz	TDD

Table 5.5A-3: Intra-band non-contiguous CA operating bands

## 5.5B Operating bands for UL-MIMO

E-UTRA UL-MIMO is designed to operate in the operating bands defined in Table 5.5-1.

Table 5.5B-1: Void

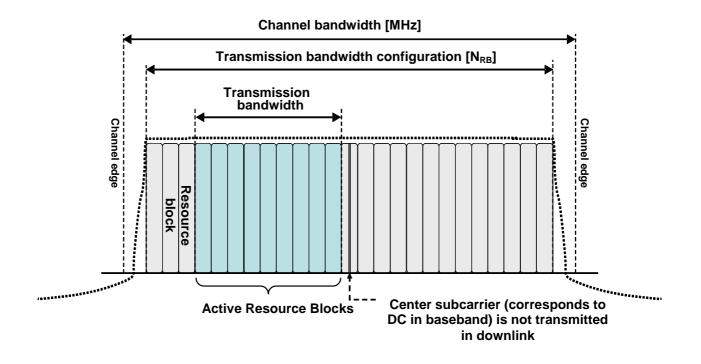
## 5.6 Channel bandwidth

Requirements in present document are specified for the channel bandwidths listed in Table 5.6-1.

#### Table 5.6-1: Transmission bandwidth configuration N<sub>RB</sub> in E-UTRA channel bandwidths

Channel bandwidth BW <sub>Channel</sub> [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N <sub>RB</sub>	6	15	25	50	75	100

Figure 5.6-1 shows the relation between the Channel bandwidth (BW<sub>Channel</sub>) and the Transmission bandwidth configuration (N<sub>RB</sub>). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at  $F_C$  +/- BW<sub>Channel</sub>/2.



# Figure 5.6-1: Definition of channel bandwidth and transmission bandwidth configuration for one E-UTRA carrier

## 5.6.1 Channel bandwidths per operating band

a) The requirements in this specification apply to the combination of channel bandwidths and operating bands shown in Table 5.6.1-1. The transmission bandwidth configuration in Table 5.6.1-1 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

		E-UTRA ba	nd / Channe	el bandwidth		
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
1			Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
3	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes <sup>1</sup>		
6			Yes	Yes <sup>1</sup>		
7			Yes	Yes	Yes <sup>3</sup>	Yes <sup>1, 3</sup>
8	Yes	Yes	Yes	Yes <sup>1</sup>		
9			Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
10			Yes	Yes	Yes	Yes
11			Yes	Yes <sup>1</sup>		
12	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>		
13			Yes <sup>1</sup>	Yes <sup>1</sup>		
14			Yes <sup>1</sup>	Yes <sup>1</sup>		
 17			Yes <sup>1</sup>	Yes <sup>1</sup>		
18			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	
19			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	
20			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1</sup>
21			Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	
22			Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
23	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
24	100	100	Yes	Yes	100	100
25	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>
26	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	
27	Yes	Yes	Yes	Yes <sup>1</sup>		
28		Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1, 2</sup>
33			Yes	Yes	Yes	Yes
34			Yes	Yes	Yes	
35	Yes	Yes	Yes	Yes	Yes	Yes
36	Yes	Yes	Yes	Yes	Yes	Yes
37			Yes	Yes	Yes	Yes
38			Yes	Yes	Yes <sup>3</sup>	Yes <sup>3</sup>
39			Yes	Yes	Yes	Yes
40			Yes	Yes	Yes	Yes
41			Yes	Yes	Yes	Yes
42			Yes	Yes	Yes	Yes
43			Yes	Yes	Yes	Yes
44		Yes	Yes	Yes	Yes	Yes
NOTE 2: 4	sensitivity red For the 20 M E-UTRA UL of 738 MHz refers to the pe restricted	quirement (su MHz bandwid carrier freque bandwidth f by the netwo	ubclause 7.3 ofth, the minine encies confine or which the ork for some	elaxation of th ) is allowed. num requiren ed to either 7 uplink transm channel assig et unwanted of	nents are spo 13-723 MHz hission bando gnments in F	ecified for or 728- width can DD/TDD
	Clause 6.6.3					Yunements

Table 5.6.1-1: E-UTRA channel bandwidth

b) The use of different (asymmetrical) channel bandwidth for the TX and RX is not precluded and is intended to form part of a later release.

## 5.6A Channel bandwidth for CA

For intra-band contiguous carrier aggregation *Aggregated Channel Bandwidth*, *Aggregated Transmission Bandwidth Configuration* and *Guard Bands* are defined as follows, see Figure 5.6A-1.

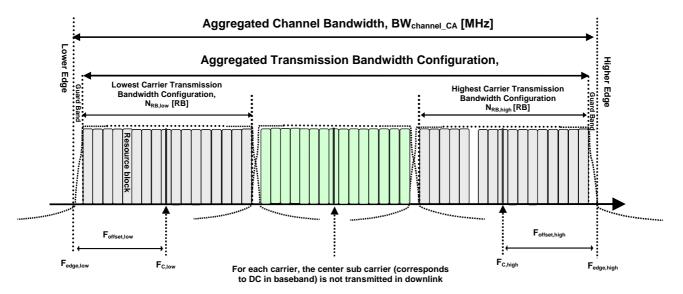


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

The aggregated channel bandwidth, BW<sub>Channel CA</sub>, is defined as

$$BW_{Channel_CA} = F_{edge,high} - F_{edge,low}$$
 [MHz]

The lower bandwidth edge  $F_{edge,low}$  and the upper bandwidth edge  $F_{edge,high}$  of the aggregated channel bandwidth are used as frequency reference points for transmitter and receiver requirements and are defined by

 $F_{edge,low} = F_{C,low} - F_{offset,low}$   $F_{edge,high} = F_{C,high} + F_{offset,high}$ 

The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as

$$\begin{split} F_{offset,low} &= (0.18 N_{RB,low} + \Delta f_1)/2 + BW_{GB} \, [MHz] \\ F_{offset,high} &= (0.18 N_{RB,high} + \Delta f_1)/2 + BW_{GB} \, [MHz] \end{split}$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while N<sub>RB,low</sub> and N<sub>RB,high</sub> are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier, respectively. BW<sub>GB</sub> denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

NOTE: The values of BW<sub>Channel\_CA</sub> for UE and BS are the same if the lowest and the highest component carriers are identical.

Aggregated Transmission Bandwidth Configuration is the number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth and is defined per CA Bandwidth Class (Table 5.6A-1).

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.6A-2.

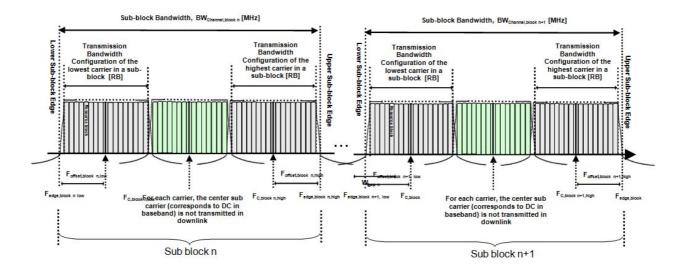


Figure 5.6A-2. Non-contiguous intraband CA terms and definitions

The lower sub-block edge of the Sub-block Bandwidth (BW<sub>Channel,block</sub>) is defined as

 $F_{edge,block, low} = F_{C,block,low} - F_{offset,block, low}$ 

The upper sub-block edge of the Sub-block Bandwidth is defined as

 $F_{edge,block,high} = F_{C,block,high} + F_{offset,block,high}$ 

The Sub-block Bandwidth, BW<sub>Channel.block</sub>, is defined as follows:

BWChannel,block = F<sub>edge,block,high</sub> - F<sub>edge,block,low [MHz]</sub>

The lower and upper frequency offsets F<sub>offset,block,low</sub> and F<sub>offset,block,high</sub> depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carriers within a sub-block and are defined as

$$\begin{split} F_{offset,block,low} &= (0.18 N_{RB,low} + \Delta f_1)/2 + BW_{GB} \, [MHz] \\ F_{offset,block,high} &= (0.18 N_{RB,high} + \Delta f_1)/2 + BW_{GB} \, [MHz] \end{split}$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while N<sub>RB,low</sub> and N<sub>RB,high</sub> are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier within a sub-block, respectively. BW<sub>GB</sub> denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

The sub-block gap size between two consecutive sub-blocks  $W_{gap}$  is defined as

 $W_{gap} = F_{edge,block n+1,low} - F_{edge,block n,high [MHz]}$ 

CA Bandwidth Class			Nominal Guard Band BW <sub>GB</sub>					
А	N <sub>RB,agg</sub> ≤ 100	1	a₁BW <sub>Channel(1)</sub> - 0.5∆f₁ (NOTE 2)					
В	N <sub>RB,agg</sub> ≤ 100	2	NOTE 3					
С	100 < N <sub>RB,agg</sub> ≤ 200	2	0.05 $max(BW_{Channel(1)}, BW_{Channel(2)}) - 0.5\Delta f_1$					
D	200 < N <sub>RB,agg</sub> ≤ 300	3	NOTE 3					
E	300 < N <sub>RB,agg</sub> ≤ 400	4	NOTE 3					
F	400 < N <sub>RB,agg</sub> ≤ 500	5	NOTE 3					
NOTE 1: BW <sub>Cha</sub>	nnel(1) and BW <sub>Channel(2)</sub> are c	hannel bandwidth	s of two E-UTRA component carriers					
accord	according to Table 5.6-1 and $\Delta f_1 = \Delta f$ for the downlink with $\Delta f$ the subcarrier spacing while $\Delta f_1 =$							
0 for th	0 for the uplink.							
NOTE 2: a <sub>1</sub> = 0.	OTE 2: $a_1 = 0.16/1.4$ for BW <sub>Channel(1)</sub> = 1.4 MHz whereas $a_1 = 0.05$ for all other channel bandwidths.							
NOTE 3: Applica	aple for later releases.							

Table 5.6A-1: CA bandwidth classes and corresponding nominal guard bands

The channel spacing between centre frequencies of contiguously aggregated component carriers is defined in subclause 5.7.1A.

## 5.6A.1 Channel bandwidths per operating band for CA

The requirements for carrier aggregation in this specification are defined for carrier aggregation configurations with associated bandwidth combination sets. For inter-band carrier aggregation, a *carrier aggregation configuration* is a combination of operating bands, each supporting a carrier aggregation bandwidth class. For intra-band contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting a carrier aggregation bandwidth class.

For each carrier aggregation configuration, requirements are specified for all bandwidth combinations contained in a *bandwidth combination set*, which is indicated per supported band combination in the UE radio access capability. A UE can indicate support of several bandwidth combination sets per band combination.

Requirements for intra-band contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-1. Requirements for inter-band carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-2.

The DL component carrier combinations for a given CA configuration shall be symmetrical in relation to channel centre unless stated otherwise in Table 5.6A.1-1 or 5.6A.1-2.

# Table 5.6A.1-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA

E-UTRA CA configuration / Bandwidth combination set						
E-UTRA CA configuration	Uplink CA configurations (NOTE 3)	Component carriers in c freq	Maximum			
		Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	aggregated bandwidth [MHz]	Bandwidth combination set	
<u></u>	CA_1C	15	15	40	0	
CA_1C		20	20	40		
CA_7C	CA_7C	15	15	40	0	
		20	20	40		
CA 28C	CA_38C	15	15	40	0	
CA_38C		20	20	40		
	CA_40C	10	20		0	
CA_40C		15	15	40		
		20	10, 20			
CA_41C	CA_41C	10	20		0	
		15	15, 20	40		
		20	10, 15, 20			
index NOTE 2: For the	king letter). Absence he supported CC b	e of a CA bandwidth class for andwidth combinations, the C	a CA bandwidth class specified an operating band implies supp C downlink and uplink bandwid orted by the present release of s	oort of all classe ths are equal.		

E-UTRA CA Configuration	Uplink CA configurations (NOTE 4)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combinatior set
CA_1A-5A	-	1 5				Yes Yes			20	0
CA_1A-18A	_	1			Yes	Yes	Yes	Yes	35	0
		18			Yes	Yes	Yes		00	•
CA_1A-19A	-	1			Yes	Yes	Yes	Yes	35	0
		19			Yes	Yes	Yes			
CA_1A-21A	-	1			Yes	Yes	Yes	Yes	35	0
		21			Yes	Yes	Yes			-
CA_2A-17A	-	2			Yes	Yes			20	0
_		17			Yes	Yes				
CA_2A-29A	-	2		N	Yes	Yes			20	0
		29		Yes	Yes	Yes	Var	Var		
		3 5			Vaa	Yes	Yes	Yes	- 30	0
CA_3A-5A	-	5			Yes	Yes Yes				
		3 5			Yes	Yes			- 20	
		3			Yes	Yes	Yes	Yes		
CA_3A-7A	-	7			165	Yes	Yes	Yes	40	0
		3				Yes	Yes	Yes		1
	-	8			Yes	Yes	103	100	- 30	0
CA_3A-8A		3			100	Yes			- 20	1
		8			Yes	Yes				
	-	3			Yes	Yes	Yes	Yes	- 30	0
CA_3A-20A		20			Yes	Yes				
<u></u>		4			Yes	Yes			- 20	0
CA_4A-5A	-	5			Yes	Yes				
		4			Yes	Yes			- 30	0
CA_4A-7A	-	7			Yes	Yes	Yes	Yes		
CA_4A-12A		4	Yes	Yes	Yes	Yes			20	0
CA_4A-12A	-	12 <sup>5</sup>			Yes	Yes			20	0
	-	4			Yes	Yes	Yes	Yes	- 30	0
CA_4A-13A		13				Yes				
CA_4A-13A		4			Yes	Yes			20	
		13				Yes			20	
CA_4A-17A		4			Yes	Yes			20	0
	-	17 <sup>5</sup>			Yes	Yes			20	
CA_4A-29A	-	4			Yes	Yes			20	
5		29		Yes	Yes	Yes				
CA_5A -12A	-	5			Yes	Yes			20	0
		12			Yes	Yes				
CA_5A-17A	-	5			Yes	Yes			20	0
· · · · · ·		17			Yes	Yes	V	V		
CA_7A-20A	-	7			Var	Yes	Yes	Yes	- 30	0
		20			Yes	Yes				
CA_8A-20A	-	8 20			Yes	Yes			20	0
_		20 11			Yes Yes	Yes Yes				
CA_11A-18A	-	11			Yes	Yes	Yes		25	0
	Configuration refe			1						

#### Table 5.6A.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA

NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.

NOTE 4: Uplink CA configurations are the configurations supported by the present release of specifications. NOTE 5: For the corresponding CA configuration, UE may not support Pcell transmissions in this E-UTRA band.

#### Table 5.6A.1-3: E-UTRA CA configurations and bandwidth combination sets defined for noncontiguous intra-band CA

E-UTRA CA configuration	Uplink CA configurations (NOTE 1)		arriers in order of arrier frequency	Maximum aggregated bandwidth [MHz]		
		Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]		Bandwidth combination set	
CA_25A-25A	-	5, 10	5, 10	20	0	
CA_41A-41A	-	10, 15, 20	10, 15, 20	40	0	

## 5.6B Channel bandwidth for UL-MIMO

The requirements specified in subclause 5.6 are applicable to UE supporting UL-MIMO.

#### 5.6B.1 Void

## 5.7 Channel arrangement

#### 5.7.1 Channel spacing

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the channel bandwidths. The nominal channel spacing between two adjacent E-UTRA carriers is defined as following:

Nominal Channel spacing =  $(BW_{Channel(1)} + BW_{Channel(2)})/2$ 

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA carriers. The channel spacing can be adjusted to optimize performance in a particular deployment scenario.

## 5.7.1A Channel spacing for CA

For intra-band contiguous carrier aggregation bandwidth class C, the nominal channel spacing between two adjacent E-UTRA component carriers is defined as the following:

Nominal channel spacing = 
$$\frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1 |BW_{Channel(1)} - BW_{Channel(2)}|}{0.6} |0.3 \text{ [MHz]}$$

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA component carriers according to Table 5.6-1 with values in MHz. The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of 300 kHz less than the nominal channel spacing to optimize performance in a particular deployment scenario.

For intra-band non-contiguous carrier aggregation the channel spacing between two E-UTRA component carriers in different sub-blocks shall be larger than the nominal channel spacing defined in this subclause.

#### 5.7.2 Channel raster

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

## 5.7.2A Channel raster for CA

For carrier aggregation the channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

#### 5.7.3 Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL_{low}}$  and  $N_{Offs-DL}$  are given in Table 5.7.3-1 and  $N_{DL}$  is the downlink EARFCN.

 $F_{DL} = F_{DL \text{ low}} + 0.1(N_{DL} - N_{Offs-DL})$ 

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where  $F_{UL\_low}$  and  $N_{Offs-UL}$  are given in Table 5.7.3-1 and  $N_{UL}$  is the uplink EARFCN.

 $F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs-UL})$ 

E-UTRA		Downlink		Uplink			
Operating Band	F <sub>DL_low</sub> (MHz)	N <sub>Offs-DL</sub>	Range of N <sub>DL</sub>	F <sub>UL_low</sub> (MHz)	N <sub>Offs-UL</sub>	Range of N <sub>UL</sub>	
1	2110	0	0 - 599	1920	18000	18000 - 18599	
2	1930	600	600 – 1199	1850	18600	18600 - 19199	
3	1805	1200	1200 – 1949	1710	19200	19200 - 19949	
4	2110	1950	1950 - 2399	1710	19950	19950 - 20399	
5	869	2400	2400 - 2649	824	20400	20400 - 20649	
6	875	2650	2650 - 2749	830	20650	20650 - 20749	
7	2620	2750	2750 - 3449	2500	20750	20750 - 21449	
8	925	3450	3450 - 3799	880	21450	21450 - 21799	
9	1844.9	3800	3800 - 4149	1749.9	21800	21800 - 22149	
10	2110	4150	4150 - 4749	1710	22150	22150 - 22749	
11	1475.9	4750	4750 - 4949	1427.9	22750	22750 - 22949	
12	729	5010	5010 - 5179	699	23010	23010 - 23179	
13	746	5180	5180 - 5279	777	23180	23180 - 23279	
14	758	5280	5280 - 5379	788	23280	23280 - 23379	
	100	0200	0200 0010	100	20200	20200 20010	
17	734	5730	5730 – 5849	704	23730	23730 - 23849	
18	860	5850	5850 - 5999	815	23850	23850 - 23999	
19	875	6000	6000 - 6149	830	24000	24000 - 24149	
20	791	6150	6150 - 6449	832	24150	24150 - 24449	
21	1495.9	6450	6450 - 6599	1447.9	24450	24450 - 24599	
22	3510	6600	6600 - 7399	3410	24600	24600 - 25399	
23	2180	7500	7500 - 7699	2000	25500	25500 - 25699	
24	1525	7700	7700 - 8039	1626.5	25700	25700 - 26039	
25	1930	8040	8040 - 8689	1850	26040	26040 - 26689	
26	859	8690	8690 - 9039	814	26690	26690 - 27039	
27	852	9040	9040 - 9209	807	27040	27040 - 27209	
28	758	9210	9210 - 9659	703	27210	27210 - 27659	
29 <sup>2</sup>	717	9660	9660 - 9769	100	N/A	21210 21000	
		0000	0000 0100				
33	1900	36000	36000 - 36199	1900	36000	36000 - 36199	
34	2010	36200	36200 - 36349	2010	36200	36200 - 36349	
35	1850	36350	36350 - 36949	1850	36350	36350 - 36949	
36	1930	36950	36950 - 37549	1930	36950	36950 - 37549	
37	1910	37550	37550 - 37749	1910	37550	37550 - 37749	
38	2570	37750	37750 - 38249	2570	37750	37750 - 38249	
39	1880	38250	38250 - 38649	1880	38250	38250 - 38649	
40	2300	38650	38650 - 39649	2300	38650	38650 - 39649	
41	2496	39650	39650 -41589	2496	39650	39650 -41589	
42	3400	41590	41590 - 43589	3400	41590	41590 - 43589	
43	3600	43590	43590 - 45589	3600	43590	43590 - 45589	
44	703	45590	45590 - 46589	703	45590	45590 - 46589	
с 7 с 1	he channel numb arrier extends bey 5 and 100 channe	ers that design rond the operated al numbers at the at the upper oper respectively.	ate carrier frequenci ting band edge shall he lower operating ba erating band edge sh	es so close to the op not be used. This in and edge and the la nall not be used for o	perating band e oplies that the fi st 6, 14, 24, 49	dges that the rst 7, 15, 25, 50, , 74 and 99	

Table 5.7.3-1: E-UTRA channel numbers

#### TX-RX frequency separation 5.7.4

a) The default E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation is specified in Table 5.7.4-1 for the TX and RX channel bandwidths defined in Table 5.6.1-1

E-UTRA Operating Band	TX - RX		
	carrier centre frequency		
	separation		
1	190 MHz		
2	80 MHz.		
3	95 MHz.		
4	400 MHz		
5	45 MHz		
6	45 MHz		
7	120 MHz		
8	45 MHz		
9	95 MHz		
10	400 MHz		
11	48 MHz		
12	30 MHz		
13	-31 MHz		
14	-30 MHz		
17	30 MHz		
18	45 MHz		
19	45 MHz		
20	-41 MHz		
21	48 MHz		
22	100 MHz		
23	180 MHz		
24	-101.5 MHz		
25	80 MHz		
26	45 MHz		
27	45 MHz		
28	55 MHz		

Table 5.7.4-1: Default UE TX-RX frequency separation

b) The use of other TX channel to RX channel carrier centre frequency separation is not precluded and is intended to form part of a later release.

## 5.7.4A TX-RX frequency separation for CA

For intra-band contiguous carrier aggregation, the same TX-RX frequency separation as specified in Table 5.7.4-1 is applied to PCC and SCC, respectively.

6 Transmitter characteristics

## 6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.

- 6.2 Transmit power
- 6.2.1 Void

## 6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	$\pm 2^2$		
3					23	$\pm 2^2$		
4					23	±2		
5					23	±2		
6					23	<u>+2</u> +2 <sup>2</sup>		
7					23	$\pm 2^2$		
8					23	$\pm 2^2$		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	$\pm 2^2$		
13					23	<u></u> ±2		
14	31	+2/-3			23	±2		
17	01	12/0			20	±£		
17					23	<u>+2</u>		
18					23	±2 ±2 <sup>5</sup>		
18					23			
						$\frac{\pm 2}{\pm 2^2}$		
20					23	<u>+2</u> ±2		
21					23			
22					23	$+2/-3.5^{2}$		
23					23 <sup>6</sup>	±2 <sup>6</sup>		
24					23	<u>+2</u>		
25					23	$\frac{\pm 2^2}{\pm 2^2}$		
26					23			
27					23	±2		
28					23	+2/-2.5		
33					23	±2		
34					23	±2		
35					23	±2		
36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40	1				23	±2		
41	1				23	$\frac{\pm 2}{\pm 2^2}$		
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
NOTE 1:	Void	<u> </u>		1	_0	[ 0]	1	L
NOTE 2:	$^{2}$ refers to the F <sub>UL_high</sub> – 4	MHz and $F_{UL_r}$				within F <sub>UL_low</sub> ar ement is relaxed		
		nit by 1.5 dB						
						g frequencies, t		is FFS.
NOTE 5:		P <sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and						
NOTE 6:		20 is signalled,	the total ou	tput power wit	hin 2000-20	05 MHz shall b	e limited to 7	dBm.

Table 6.2.2-1: UE Power Class

#### UE maximum output power for CA 6.2.2A

The following UE Power Classes define the maximum output power for any transmission bandwidth within the aggregated channel bandwidth.

The maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the requirements in subclause 6.2.2 apply.

For intra-band contiguous carrier aggregation the maximum output power is specified in Table 6.2.2A-1.

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_1C					23	+2/-2		
CA_7C					23	$+2/-2^{2}$		
CA_38C					23	+2/-2		
CA_40C					23	+2/-2		
CA_41C		23 +2/-2 <sup>2</sup>						
	NOTE 1: Void NOTE 2: If all transmitted resource blocks (Figure 5.6A-1) over all component carriers are confined within F <sub>UL_low</sub> and							
$F_{UL_{low}}$ + 4 MHz or/and $F_{UL_{high}}$ – 4 MHz and $F_{UL_{high}}$ , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB								
NOTE 3: PPowerClass is the maximum UE power specified without taking into account the tolerance								
NOTE 4: For intra-band contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).								

Table 6.2.2A-1: CA UE Power Class

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.2 apply.

## 6.2.2B UE maximum output power for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	+2/-3		
2					23	+2/-3 <sup>2</sup>		
3					23	+2/-32		
4					23	+2/-3		
5					23	+2/-3		
6					23	+2/-3		
7					23	+2/-3 <sup>2</sup>		
8					23	+2/-3 <sup>2</sup>		
9					23	+2/-3		
10					23	+2/-3		
11					23	+2/-3		
12					23	$+2/-3^{2}$		
13					23	+2/-3		
14					23	+2/-3		
						, 0		
17					23	+2/-3		
18					23	+2/-3		
19					23	+2/-3		
20					23	$+2/-3^2$		
21					23	+2/-3		
22					23	$+2/-4.5^2$		
					23	+2/-4.5		
23					23	+2/-3		
23					23	+2/-3		
24					23	$+2/-3^{2}$		
26					23	+2/-3 <sup>2</sup>		
20					23	+2/-3		
27					23	+2/-3		
					23	+2/[-3]		
						. 0/ 0		
33					23	+2/-3		
34					23			
35					23	+2/-3		
36					23	+2/-3	-	
37					23	+2/-3		
38					23	+2/-3		
39					23	+2/-3		
40					23	+2/-3		
41					23	$+2/-3^{2}$		
42					23	+2/-4		
43					23	+2/-4		
44					23	+2/[-3]		
	<sup>2</sup> refers to the $F_{UL_high} - 4$ tolerance line	MHz and F <sub>UL_h</sub> nit by 1.5 dB	<sub>iigh</sub> , the maxi	imum output p	ower require	within F <sub>UL_low</sub> ar ement is relaxe g frequencies, t	d by reducing	g the lower
						o account the t		

Table 6.2.2B-1: UE Power Class for UL-MIMO in closed loop spatial multiplexing scheme

#### Table 6.2.2B-2: UL-MIMO configuration in closed-loop spatial multiplexing scheme

Transmission mode	DCI format	Codebook Index
Mode 2	DCI format 4	Codebook index 0

For single-antenna port scheme, the requirements in subclause 6.2.2 apply.

## 6.2.3 UE maximum output power for modulation / channel bandwidth

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

Modulation	Channel bandwidth / Transmission bandwidth (NRB)					MPR (dB)	
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1 and 3

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For transmissions with non-contiguous resource allocation in single component carrier, the allowed Maximum Power Reduction (MPR) for the maximum output power in table 6.2.2-1, is specified as follows

$$MPR = CEIL \{M_A, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$M_A =$	8.00-10.12A	; 0.00< A $\leq$ 0.33
	5.67 - 3.07A	; 0.33< A ≤0.77
	3.31	; 0.77< A $\leq$ 1.0

Where

 $A = N_{RB\_alloc} \ / \ N_{RB}$ 

CEIL{M<sub>A</sub>, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR  $\in$  [3.0, 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0]

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

# 6.2.3A UE Maximum Output power for modulation / channel bandwidth for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band (Table 5.6A-1), the requirements in subclause 6.2.3 apply.

For intra-band contiguous carrier aggregation the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1due to higher order modulation and contiguously aggregated transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3A-1. In case the modulation format is different on different component carriers then the MPR is determined by the rules applied to higher order of those modulations.

Modulation		CA bandwidth Class C					
	50 RB + 100 RB	75 RB + 75 RB	75 RB+100 RB	100 RB + 100 RB	(dB)		
QPSK	> 12 and ≤ 50	> 16 and ≤ 75	> 16 and ≤ 75	> 18 and ≤ 100	≤1		
QPSK	> 50	> 75	> 75	> 100	≤2		
16 QAM	≤ 12	≤ 16	≤ 16	≤ 18	≤ 1		
16 QAM	> 12 and ≤ 50	> 16 and ≤ 75	> 16 and ≤ 75	> 18 and ≤ 100	≤2		
16 QAM	> 50	> 75	> 75	> 100	≤ 3		

Table 6.2.3A-1: Maximum Power Reduction (MPR) for Power Class 3

For PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{M_{A}, 0.5\}$$

Where MA is defined as follows

$M_A =$	8.2	; $0 \le A < 0.025$
	9.2 - 40A	; $0.025\!\le\!A\!<\!0.05$
	8 – 16A	; 0.05 $\leq A < 0.25$
	4.83 - 3.33A	; $0.25 \le A \le 0.4$ ,
	3.83 - 0.83A	; 0.4 $\leq$ A $\leq$ 1,

Where

 $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

CEIL{ $M_{A, 0.5}$ } means rounding upwards to closest 0.5dB, i.e. MPR  $\in$  [3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5]

For intra-band carrier aggregation, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5A apply.

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.3 apply.

# 6.2.3B UE maximum output power for modulation / channel bandwidth for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2B-1 is specified in Table 6.2.3-1. The requirements shall be met with UL-MIMO configurations defined in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.3 apply.

## 6.2.4 UE maximum output power with additional requirements

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks ( <i>N</i> <sub>RB</sub> )	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
			3	>5	≤ 1
		0 4 40 00 05	5	>6	≤ 1
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	10	>6	≤ 1
		35, 50	15	>8	≤1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤1
NS_04	0.0.2.2.2	41	10, 15, 20		6.2.4-4
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table	6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
	6.6.3.3.4	21	10, 15	> 40	≤ 1
NS_09	0.0.3.3.4	21	10, 15	> 55	≤ 2
NS_10		20	15, 20	Table	6.2.4-3
NS_11	6.6.2.2.1 6.6.3.3.13	23	1.4, 3, 5, 10, 15, 20	Table	6.2.4-5
NS_12	6.6.3.3.5	26	1.4, 3, 5	Table	6.2.4-6
NS_13	6.6.3.3.6	26	5	Table	6.2.4-7
NS_14	6.6.3.3.7	26	10, 15	Table	6.2.4-8
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15		6.2.4-9 6.2.4-10
NS_16	6.6.3.3.9	27	3, 5, 10		, Table 6.2.4-12, 6.2.4-13
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	5	≥ 2	≤ 1
10_10		_	10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table	6.2.4-14
NS_20	6.2.2 6.6.2.2.1 6.6.3.3.14	23	5, 10, 15, 20	Table	6.2.4-15
NS_22	6.6.3.3.15	42, 43	5, 10, 15, 20	Table	6.2.4-16
NS_23	6.6.3.3.16	42, 43	5, 10, 15, 20	Ν	I/A
 NS_32	-	-	-	-	

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Parameters	R	egion A	Regi	Region B			
RB <sub>start</sub>		0 - 12	13 – 18	19 – 42	43 – 49		
L <sub>CRB</sub> [RBs]	6-8	1 to 5 and 9-50	≥8	≥18	≤2		
A-MPR [dB]	≤ 8	≤ 12	≤ 12	≤ 6	≤ 3		
<ul> <li>NOTE 1; RB<sub>start</sub> indicates the lowest RB index of transmitted resource blocks</li> <li>NOTE 2; L<sub>CRB</sub> is the length of a contiguous resource block allocation</li> <li>NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.</li> </ul>							
NOTE 4; For intra-			ng between two re both slots in the si	•	A-MPR value of		

Table 6.2.4-2: A-MPR for "NS\_07"

Table 6.2.4-3: A-MPR for "NS\_10"

Channel bandwidth [MHz]	Parameters	Region A			
	RB <sub>start</sub>	0 – 10			
15	L <sub>CRB</sub> [RBs]	1 -20			
	A-MPR [dB]	≤2			
	RB <sub>start</sub>	0 – 15			
20	L <sub>CRB</sub> [RBs]	1 -20			
	A-MPR [dB]	≤ 5			
NOTE 1: RB <sub>start</sub> inc	licates the lowest RB index	of transmitted resource blocks			
NOTE 2: LCRB is th	e length of a contiguous re	source block allocation			
NOTE 3: For intra-	subframe frequency hoppir	ng which intersects Region A, notes 1 and 2 apply			
on a per slot basis					
NOTE 4: For intra-subframe frequency hopping which intersect Region A, the larger A-MPR value may be applied for both slots in the subframe					

Table 6.2.4-4: A-MPR rec	quirements for "NS	04" with bandwidth >5MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
10	RB <sub>start</sub>	0 – 12	13 – 36	37 – 49
	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	N/A	>37	N/A <sup>3</sup>
	A-MPR [dB]	≤3dB	≤2dB	≤3dB
15	RB <sub>start</sub>	0 – 18	19 – 55	56 – 74
	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	N/A	>56	N/A <sup>3</sup>
	A-MPR [dB]	≤3dB	≤2dB	≤3dB
20	RB <sub>start</sub>	0 – 24	25 – 74	75 – 99
	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	N/A <sup>3</sup>	>75	N/A <sup>3</sup>
	A-MPR [dB]	≤3dB	≤2dB	≤3dB
NOTE 2: L <sub>CRB</sub> is t NOTE 3: <sup>3</sup> refers NOTE 4: For intra NOTE 5: For intra	adicates the lowest RB index of the length of a contiguous resound to any RB allocation that starts in a-subframe frequency hopping was bubframe frequency hopping was in the subframe	rce block allocation n Region A or C is allow /hich intersects regions	ved the specified A-MF , notes 1 and 2 apply o	n a per slot basis

Channel Bandwidth [MHz]		Parameters								
	Fc [MHz]	<20	04			≥2004				
3	L <sub>CRB</sub> [RBs]	1-1	15			>5				
	A-MPR [dB]	<u>≤</u> {				≤ 1				
	Fc [MHz]	<20	04		200	)4 ≤ Fc <	2007		≥2	007
5	L <sub>CRB</sub> [RBs]	1-2	25			6 & -25	8-12		>	•6
	A-MPR [dB]	≤	7		≤	4	0		<	1
	Fc [MHz]	200	)5 ≤	Fc <2	2015	5		201	5	
	RB <sub>start</sub>	0-49					0-4	9		
10	L <sub>CRB</sub> [RBs]	1-50			1-50					
	A-MPR [dB]	≤ 12			0					
	Fc [MHz]					<2012	2.5			
	RB <sub>start</sub>	0-4			5-21	1	22	2-56		57-74
	L <sub>CRB</sub> [RBs]	≥1	7-:	50	0-	6 & ≥50	≤25	>2	5	>0
	A-MPR [dB]	≤15	≤	7		≤10	0	≤6	6	≤15
15	Fc [MHz]					2012	.5			
	RB <sub>start</sub>	0-12			13	-39	40-6	5		66-74
	L <sub>CRB</sub> [RBs]	≥1		≥3	0	<30	≥ (69 – RB <sub>start</sub> )			≥1
	A-MPR [dB]	≤10		≤6	6	0	≤2			≤6.5
	Fc [MHz]					2010	)			
	RB <sub>start</sub>	0-12		1	3-29	9	30-68			69-99
20	L <sub>CRB</sub> [RBs]	≥1	10	-60		1-9 & >60	1-24	≥2	5	≥1
	A-MPR [dB]	≤15	1	≦7		≤10	0	≤7	7	≤15

Table 6.2.4-5: A-MPR for "NS\_11"

Channel bandwidth [MHz]	Parameters	Regio	Region B	
	RB <sub>start</sub>	0		1-2
1.4	L <sub>CRB</sub> [RBs]	≤3	≥4	≥4
	A-MPR [dB]	≤3	≤6	≤3
	RB <sub>start</sub>	0-	3	4-5
3	L <sub>CRB</sub> [RBs]	4-9	1-3 and 10-15	≥9
	A-MPR [dB]	≤4	≤3	≤3
	RB <sub>start</sub>	0-6		7-9
5	L <sub>CRB</sub> [RBs]	≤8	≥9	≥15
	A-MPR [dB]	≤5	≤3	≤3

Table 6.2.4-6: A-MPR for "NS\_12"

Table 6.2.4-7: A-MPR for "NS\_13"

Channel bandwidth [MHz]	Parameters	Region A	
	RB <sub>start</sub>	0-2	2
5	L <sub>CRB</sub> [RBs]	≤5	≥18
	A-MPR [dB]	≤3	≤2

#### Table 6.2.4-8: A-MPR for "NS\_14"

Channel bandwidth [MHz]	Parameters	Region A	
	RB <sub>start</sub>	0	
10	L <sub>CRB</sub> [RBs]	≤5	=50
	A-MPR [dB]	≤3	≤1
	RB <sub>start</sub>	3≥	3
15	L <sub>CRB</sub> [RBs]	≤16	≥50
	A-MPR [dB]	≤3	≤1

Table 6.2.4-9: A-MPR for "NS\_15" for E-UTRA highest channel edge > 845 MHz and ≤ 849 MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
1.4	RB <sub>end</sub> [RB]			4-5
1.4	A-MPR [dB]			≤3
	RB <sub>end</sub> [RB]	0-1	8-12	13-14
3	L <sub>CRB</sub> [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB <sub>end</sub> [RB]	0-4	12-19	20-24
5	L <sub>CRB</sub> [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤5	≤9
	RB <sub>end</sub> [RB]	0-12	23-36	37-49
10	L <sub>CRB</sub> [RB]	≤2	≥15	>0
	A-MPR [dB]	≤4	≤6	≤9
	RB <sub>end</sub> [RB]	0-20	26-53	54-74
15	L <sub>CRB</sub> [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
	RB <sub>end</sub> [RB]			19-24
5	L <sub>CRB</sub> [RB]			≥18
	A-MPR [dB]			≤2
	RB <sub>end</sub> [RB]	0-4	29-44	45-49
10	L <sub>CRB</sub> [RB]	≤2	≥24	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB <sub>end</sub> [RB]	0-12	44-61	62-74
15	L <sub>CRB</sub> [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Table 6.2.4-10: A-MPR for "NS\_15" for E-UTRA highest channel edge ≤ 845 MHz

## Table 6.2.4-11: A-MPR for "NS\_16" with channel lower edge at ≥807 MHz and <808.5 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB <sub>start</sub>	0	1-2			
3 MHz	L <sub>CRB</sub> [RBs]	≥12	12			
	A-MPR [dB]	≤2	≤1			
	RB <sub>start</sub>	0-1	2	2-9	2-5	
5 MHz	L <sub>CRB</sub> [RBs]	1 - 25	12	15-18	20	
	A-MPR [dB]	≤5	≤1	≤2	≤3	
	RB <sub>start</sub>	0 - 8	0-	14	15-20	15-24
10 MHz	L <sub>CRB</sub> [RBs]	1 - 12	15-20	≥24	≥30	24-27
	A-MPR [dB]	≤5	≤3	≤7	≤3	≤1

Table 6.2.4-12: A-MPR for "NS	_16" with channel lower edge at ≥808.5 MHz and <812 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB <sub>start</sub>	0	0-1	1-5		
5 MHz	L <sub>CRB</sub> [RBs]	16-20	≥24	16-20		
	A-MPR [dB]	≤2	≤3	≤1		
	RB <sub>start</sub>	0.	-6	0-10	0-14	11-20
10 MHz	L <sub>CRB</sub> [RBs]	1-12	15-20	24-32	≥36	24-32
	A-MPR [dB]	≤5	≤2	≤4	≤5	≤1

Table 6.2.4-13: A-MPR for "N	IS_16"	with channel	lower edge at ≥812 MHz
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Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D
	RB <sub>start</sub>	0 - 9	0	1-14	0-5
10 MHz	L <sub>CRB</sub> [RBs]	27-32	36-40	36-40	≥45
	A-MPR [dB]	≤1	≤2	≤1	≤3

Channel bandwidth [MHz]	Parameters	Region A		Region B
	RB <sub>start</sub>			0-6
10	L <sub>CRB</sub> [RBs]			≥40
	A-MPR [dB]			≤1
	RB <sub>start</sub>	0.	·6	7-20
15	L <sub>CRB</sub> [RBs]	≤18	≥36	≥42
	A-MPR [dB]	≤2	≤3	≤2
	RB <sub>start</sub>	0-	14	15-30
20	L <sub>CRB</sub> [RBs]	≤40	≥45	≥50
	A-MPR [dB]	≤2	≤3	≤2

## Table 6.2.4-14: A-MPR for "NS\_19"

## Table 6.2.4-15: A-MPR for "NS\_20"

Channel Bandwidth [MHz]	Parameters									
	Fc [MHz]	< 20	< 2007.5 2007.5 ≤ Fc < 2012.5 ≤ Fc ≤ 2017.5					c ≤ 2017.5		
5	RB <sub>start</sub>	≤2	24		0	-3		4-6	≤;	24
5	L <sub>CRB</sub> [RBs]	^	0	1:	5-19	≥2	0	≥18	1-	25
	A-MPR [dB]	Ň	17		≤1	≤4	Ļ	≤2	≤	0
	Fc [MHz]					2	2005			
	RB <sub>start</sub>		0-25				26-34		35	-49
	L <sub>CRB</sub> [RBs]		>0		8	3-15		>15	>	0
10	A-MPR [dB]		≤16			≤2		≤5	≤	6
10	Fc [MHz]	2015								
	RB <sub>start</sub>		0-	5				6-10		
	L <sub>CRB</sub> [RBs]		≥3	2				≥40		
	A-MPR [dB]		<u>≤</u> 4	4				≤2		
	Fc [MHz]					20	012.5			
15	RB <sub>start</sub>		0-14				15-2	1	25-39	61-74
15	L <sub>CRB</sub> [RBs]	1-9 & 4	0-75	10-3	39	24-2	29	≥30	≥36	≤6
	A-MPR [dB]	≤11		≤6		≤1		≤7	≤5	≤6
	Fc [MHz]					2	2010			-
20	RB <sub>start</sub>	0-21		22-31			32-38	39-49	50-68	69-99
20	L <sub>CRB</sub> [RBs]	>0	1-9&3	1-75	10-3	30	≥15	≥24	≥25	>0
	A-MPR [dB]			≤9	≤7	≤5	≤16			
NOTE 2: When	UL carrier center frequencies of 2005 MHz or 2015 MHz. NOTE 2: When NS_20 is signaled the minimum requirements for the 15 MHz channel bandwidth are specified for E-UTRA UL carrier center frequency of 2012.5 MHz.									

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C	Region D
5	N	o A-MPR is neede	d for 5 MHz chanr	nel bandwidth	
10	RB <sub>start</sub>	0-13	0-17	≤ 6	≥12
	L <sub>CRB</sub> [RBs]	> 36	33-36	≤ 32	≤ 32
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥44
	A-MPR [dB]	≤ 4	≤ 3	≤ 3	≤ 3
15	RB <sub>start</sub>	0-24	0-38	≤ 14	≥ 23
	L <sub>CRB</sub> [RBs]	> 50	37-50	≤ 36	≤ 36
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥59
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3
20	RB <sub>start</sub>	0-35	0-51	≤ 21	≥ 31
	L <sub>CRB</sub> [RBs]	> 64	49-64	≤ 48	≤ 48
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥79
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3

#### Table 6.2.4-16: A-MPR for "NS\_22"

frame frequency hopping between two regions, notes 1 and 2

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

For PRACH, PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5 apply.

#### 6.2.4A UE maximum output power with additional requirements for CA

Additional ACLR, spectrum emission and spurious emission requirements for carrier aggregation can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the CA Power Class as specified in Table 6.2.2A-1.

If for intra-band carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field additionalSpectrumEmissionSCellr10. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0 dB, unless the value indicated is CA NS 31.

CA Network Signalling value	Requirements (subclause)	Uplink CA Configuration	A-MPR [dB] (subclause)	
CA_NS_01	6.6.3.3A.1	CA_1C	6.2.4A.1	
CA_NS_02	6.6.3.3A.2	CA_1C	6.2.4A.2	
CA_NS_03	6.6.3.3A.3	CA_1C	6.2.4A.3	
CA_NS_04	6.6.2.2A.1	CA_41C	6.2.4A.4	
CA_NS_05	6.6.3.3A.4	CA_38C	6.2.4A.5	
CA_NS_06	6.6.3.3A.5	CA_7C	6.2.4A.6	
CA_NS_31	NOTE 1	Table 5.6A.1-1 (NOTE 1)	N/A	
CA_NS_32		Reserved		
<ul> <li>NOTE 1: Applicable for uplink CA configurations listed in Table 5.6A.1-1 for which none of the additional requirements in subclauses 6.6.2.2A or 6.6.3.3A apply.</li> <li>NOTE 2: The index of the sequence CA_NS corresponds to the value of additionalSpectrumEmissionSCell-</li> </ul>				
r10.			I UIIILIIIISSIOIISCEII-	

Table 6.2.4A-1: Additional Maximum Power Reduction (A-MPR) for intra-band contiguous CA

For PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band carrier aggregation, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR specified in table 6.2.4A-1, the power limits specified in subclause 6.2.5A apply.

#### 6.2.4A.1 A-MPR for CA\_NS\_01 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCC and the SCC for contiguously aggregated signals is specified in table 6.2.4A.1-1.

CA_1C: CA_NS_01	RB <sub>start</sub>	L <sub>CRB</sub> [RBs]	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	A-MPR for QPSK and 16- QAM [dB]	
	0 – 23 and 176 – 199	> 0	N/A	≤ 12.0	
100 RB / 100 RB	24 – 105	> 64	N/A	≤ 6.0	
	106 – 175	N/A	> 175	≤ 5.0	
	0 – 6 and 143	0 < L <sub>CRB</sub> ≤ 10	N/A	≤ 11.0	
75 RB / 75 RB	- 149	> 10	N/A	≤ 6.0	
	7 – 90	> 44	N/A	≤ 5.0	
	91 – 142	N/A	> 142	≤ 2.0	
<ul> <li>NOTE 1: RB<sub>_start</sub> indicates the lowest RB index of transmitted resource blocks</li> <li>NOTE 2: L<sub>_CRB</sub> is the length of a contiguous resource block allocation</li> <li>NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis</li> <li>NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe</li> </ul>					

Table 6.2.4A.1-1: Contiguous allocation A-MPR for CA\_NS\_01

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

A-MPR = CEIL 
$$\{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

 $M_A = -22.5 \ A + 17 \qquad ; 0 \le A < 0.20$ 

-11.0 A + 14.7 ; 
$$0.20 \le A < 0.70$$
  
-1.7 A + 8.2 ;  $0.70 \le A \le 1$ 

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.2 A-MPR for CA\_NS\_02 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.2-1.

CA_1C: CA_NS_02	RB <sub>end</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK and 16 –QAM [dB]
	0 –20	> 0	≤ 4 dB
	21 – 46	> 0	≤ 3 dB
100 RB / 100 RB	47 – 99	> RB <sub>end</sub> - 20	≤ 3 dB
	100 – 184	> 75	≤ 6 dB
	185 – 199	> 0	≤ 10 dB
	0 – 48	> 0	≤ 2 dB
	49 - 80	> RB <sub>end</sub> - 20	≤ 3 dB
75 RB / 75 RB	81 – 129	> 60	≤ 5 dB
	130 – 149	> 84	≤ 6 dB
	130 – 149	1 – 84	≤ 2 dB

Table 6.2.4A.2-1: Contiguous allocation A-MPR for CA\_NS\_02

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL  $\{M_{A}, 0.5\}$ 

Where MA is defined as follows

$$\begin{split} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ & -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ & -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

## 6.2.4A.3 A-MPR for CA\_NS\_03 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_03 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.3-1.

CA_1C: CA_NS_03	RB <sub>end</sub>	L <sub>CRB</sub> [RBs]	A-MPR for QPSK and 16-QAM [dB]
	0 – 26	> 0	≤ 10 dB
	27 – 63	≥ RB <sub>end</sub> - 27	≤ 6 dB
100 RB / 100 RB	27 – 63	< RB <sub>end</sub> - 27	≤ 1 dB
	64 – 100	> RB <sub>end</sub> - 20	≤ 4 dB
	101 – 171	> 68	≤ 7 dB
	172 – 199	> 0	≤ 10 dB
	0 – 20	> 0	≤ 10 dB
	21 – 45	> 0	≤ 4 dB
75 RB / 75 RB	46 – 75	> RB <sub>end</sub> – 13	≤ 2 dB
13 KD / 13 KD	76 – 95	> 45	≤ 5 dB
	96 – 149	> 43	≤ 8 dB
	120 – 149	1 - 43	≤ 6 dB

Table 6.2.4A.3-1: Contiguous allocation A-MPR for CA\_NS\_03

If the UE is configured to CA\_1C and it receives IE CA\_NS\_03 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL 
$$\{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{split} M_A = & -23.33A + 17.5 & ; \ 0 \leq A < 0.15 \\ & -7.65A + 15.15 & ; \ 0.15 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.4 A-MPR for CA\_NS\_04

If the UE is configured to CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.4-1.

CA Bandwidth Class C	RB <sub>Start</sub>	L <sub>CRB</sub> [RBs]	RB <sub>start</sub> + L <sub>CRB</sub> [RBs]	A-MPR for QPSK [dB]	A-MPR for 16QAM [dB]
50RB / 100 RB	0 – 44 and 105 – 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤3dB	≤4dB
75 RB / 75 RB	0 – 44 and 105 – 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤4dB	≤4dB
100 RB / 75 RB	0 – 49 and 125 – 174	>0	N/A	≤4dB	≤4dB
	50 - 124	N/A	>125	≤3dB	≤4dB
100 RB / 100 RB	0 – 59 and 140 – 199	>0	N/A	≤3dB	≤4dB
	60– 139	N/A	>140	≤3dB	≤4dB
NOTE 1:       RB <sub>start</sub> indicates the lowest RB index of transmitted resource blocks         NOTE 2:       L <sub>CRB</sub> is the length of a contiguous resource block allocation         NOTE 3:       For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis         NOTE 4:       For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe					

If the UE is configured to CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{split} \mathbf{M}_{A} &= 10.5, & 0 \leq A < 0.05 \\ &= -50.0A + 13.00, & 0.05 \leq A < 0.15 \\ &= -4.0A + 6.10, & 0.15 \leq A < 0.40 \\ &= -0.83A + 4.83, & 0.40 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.5 A-MPR for CA\_NS\_05 for CA\_38C

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.5-1.

CA_38C	$RB_{end}$	L <sub>CRB</sub> [RBs]	A-MPR for QPSK and 16-QAM [dB]		
	0 – 12	>0	≤ 5 dB		
40000/40000	13 – 79	> RB <sub>end</sub> – 13	≤ 2 dB		
100RB/100RB	80 - 180	>60	≤ 6 dB		
	181 – 199	> 0	≤ 11 dB		
	0 – 70	> max (0, RB <sub>end</sub> -10)	≤ 2 dB		
	71- 108	> 60	≤ 5 dB		
75RB/75RB	109 – 139	>0	≤ 5 dB		
	140 – 149	≤ 70	≤ 2 dB		
	140 – 149	>70	≤ 6 dB		
<ul> <li>NOTE 1: RB<sub>end</sub> indicates the highest RB index of transmitted resource blocks</li> <li>NOTE 2: L<sub>CRB</sub> is the length of a contiguous resource block allocation</li> <li>NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis</li> <li>NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-</li> </ul>					

Table 6.2.4A.5-1: Contigous Allocation A-MPR for CA\_NS\_05

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A, 0.5}\}$$

Where MA is defined as follows

$$\begin{split} M_A &= -14.17 \; A + 16.50 \qquad ; \; 0 \leq A < 0.60 \\ &- 2.50 \; A + 9.50 \qquad ; \; 0.60 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg}$ 

#### 6.2.4A.6 A-MPR for CA\_NS\_06

If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.6-1.

CA Bandwidth Class C	$RB_{end}$	L <sub>CRB</sub> [RBs]	A-MPR for QPSK and 16-QAM [dB]
	0 –22	>0	≤4 dB
	23 – 99	> max(0, RB <sub>end</sub> – 25)	≤ 2 dB
100RB/100RB	100 – 142	> 75	≤ 3 dB
	143 – 177	>70	≤ 5 dB
	178 – 199	> 0	≤ 10 dB
	0 – 7	>0	≤ 5 dB
	8- 74	> max(0, RB <sub>end</sub> – 10)	≤ 2 dB
75RB/75RB	75 – 109	>64	≤ 2 dB
	110 – 144	>35	≤ 6 dB
	145 – 149	>0	≤ 10 dB

Table 6.2.4A.6-1: Contiguous	Allocation A-M	R for CA_NS_06
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If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL  $\{M_{A}, 0.5\}$ 

Where M<sub>A</sub> is defined as follows

 $\begin{array}{rl} M_A=&-23.33A+17.5+10A & ; \ 0\leq A<0.15 \\ & -7.65A+15.15+1.18A+1.32 & ; \ 0.15\leq A\leq 1 \end{array}$ 

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

## 6.2.4B UE maximum output power with additional requirements for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in subclause 6.2.4 shall apply to the maximum output power specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.4 apply.

## 6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell *c*. The configured maximum output power  $P_{CMAX,c}$  is set within the following bounds:

$$P_{CMAX_L,c} \leq P_{CMAX,c} \leq P_{CMAX_H,c}$$

with

$$P_{CMAX\_L,c} = MIN \{P_{EMAX,c} - \Delta T_{C,c}, P_{PowerClass} - MAX(MPR_c + A-MPR_c + \Delta T_{IB,c} + \Delta T_{C,c}, P-MPR_c)\}$$

 $P_{CMAX_H,c} = MIN \{P_{EMAX,c}, P_{PowerClass}\}$ 

where

- P<sub>EMAX,c</sub> is the value given by IE *P-Max* for serving cell *c*, defined in [7];

- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR<sub>c</sub> and A-MPR<sub>c</sub> for serving cell c are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$  is the additional tolerance for serving cell c as specified in Table 6.2.5-2;  $\Delta T_{IB,c} = 0$  dB otherwise;
- $\Delta T_{C,c} = 1.5$  dB when Note 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c} = 0$  dB when Note 2 in Table 6.2.2-1 does not apply.

P-MPR<sub>c</sub> is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

The UE shall apply P-MPR<sub>c</sub> for serving cell c only for the above cases. For UE conducted conformance testing P-MPR shall be 0 dB

NOTE 1: P-MPR<sub>c</sub> was introduced in the  $P_{CMAX,c}$  equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.

NOTE 2: P-MPR<sub>c</sub> may impact the maximum uplink performance for the selected UL transmission path.

For each subframe, the  $P_{CMAX\_L,c}$  for serving cell *c* is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX\_L,c}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured configured maximum output power P<sub>UMAX,c</sub> shall be within the following bounds:

 $P_{CMAX\_L,c} - MAX\{T_{L,c}, T(P_{CMAX\_L,c})\} \leq P_{UMAX,c} \leq P_{CMAX\_H,c} + T(P_{CMAX\_H,c})$ 

where the tolerance  $T(P_{CMAX,c})$  for applicable values of  $P_{CMAX,c}$  is specified in Table 6.2.5-1. The tolerance  $T_{L,c}$  is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.2-1.

Р <sub>смах,с</sub> (dBm)	Tolerance T(P <sub>CMAX,c</sub> ) (dB)
$23 < P_{CMAX,c} \le 33$	2.0
$21 \le P_{CMAX,c} \le 23$	2.0
$20 \le P_{CMAX,c} < 21$	2.5
$19 \le P_{CMAX,c} < 20$	3.5
18 ≤ P <sub>CMAX,c</sub> < 19	4.0
13 ≤ P <sub>CMAX,c</sub> < 18	5.0
8 ≤ P <sub>CMAX,c</sub> < 13	6.0
$-40 \le P_{CMAX,c} < 8$	7.0

#### Table 6.2.5-1: PCMAX.c tolerance

For the UE which supports inter-band carrier aggregation configurations with the uplink assigned to one E-UTRA band the  $\Delta T_{IB,c}$  is defined for applicable bands in Table 6.2.5-2.

Inter-band CA	E-UTRA Band	ΔT <sub>IB,c</sub> [dB]
Configuration		
CA_1A-5A	1	0.3
	5	0.3
CA_1A-18A	1 18	0.3
	1	0.3
CA_1A-19A	19	0.3
	1	0.3
CA_1A-21A	21	0.3
CA_2A-17A	2	0.3
	17	0.8
CA_2A-29A	2	0.3
	3	0.3
CA_3A-5A	5	0.3
	3	0.5
CA_3A-7A	7	0.5
	3	0.3
CA_3A-8A	8	0.3
CA_3A-20A	3	0.3
	20	0.3
CA_4A-5A	4	0.3
	5	0.3
CA_4A-7A	4 7	0.5
	4	0.3
CA_4A-12A	12	0.8
	4	0.3
CA_4A-13A	13	0.3
	4	0.3
CA_4A-17A	17	0.8
CA_4A-29A	4	0.3
CA_5A-12A	5	0.8
	12	0.4
CA_5A-17A	5 17	0.8
	7	0.4
CA_7A-20A	20	0.3
	8	0.4
CA_8A-20A	20	0.4
CA_11A-18A	11	0.3
	18	0.3
bands configu	ove additional tolerances are only ap that belong to the supported inter-ban ırations	d carrier aggregation
suppor	ove additional tolerances also apply in ted E-UTRA operating bands that bein aggregation configurations	
NOTE 3: In case aggreg	the UE supports more than one of th ation configurations and a E-UTRA operation	perating band belongs to more than
- Whe	er-band carrier aggregation configura en the E-UTRA operating band freque	ency range is $\leq$ 1GHz, the
	icable additional tolerance shall be th	•
	cated to one decimal place for that op	
UL :	configurations. In case there is a harn and high band DL, then the maximum ported carrier aggregation configuration	n tolerance among the different
appl		-
appl	icable additional tolerance shall be th ies for that operating band among the	e maximum tolerance above that

Table 6.2.5-2: ΔT<sub>IB,c</sub>

- NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE: To meet the  $\Delta T_{IB,c}$  requirements for CA\_3A-7A with state-of-the-art technology, an increase in power consumption of the UE may be required. It is also expected that as the state-of-the-art technology evolves in the future, this possible power consumption increase can be reduced or eliminated.

## 6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell *c* and its total configured maximum output power  $P_{CMAX}$ .

The configured maximum output power  $P_{CMAX,c}$  on serving cell c shall be set as specified in subclause 6.2.5.

For uplink intra-band contiguous carrier aggregation,  $MPR_c = MPR$  and  $A-MPR_c = A-MPR$  with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR  $_c = P-MPR$ .  $P_{CMAX,c}$  is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

#### Table 6.2.5A-1:Void

The total configured maximum output power PCMAX shall be set within the following bounds:

$$P_{CMAX_L} \le P_{CMAX} \le P_{CMAX_H}$$

For uplink intra-band contiguous carrier aggregation,

$$P_{CMAX L} = MIN\{10 \log_{10} \sum p_{EMAX,c} - \Delta T_{C}, P_{PowerClass} - MAX(MPR + A-MPR + \Delta T_{IB,c} + \Delta T_{C}, P-MPR)\}$$

$$P_{CMAX H} = MIN\{10 \log_{10} \sum p_{EMAX,c}, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$  is the linear value of  $P_{EMAX,c}$  which is given by IE *P-Max* for serving cell *c* in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;
- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{IB,c}$  is the additional tolerance for serving cell *c* as specified in Table 6.2.5-2;
- P-MPR is the power management term for the UE;
- $\Delta T_{C}$  is the highest value  $\Delta T_{C,c}$  among all serving cells *c* in the subframe over both timeslots.  $\Delta T_{C,c} = 1.5$  dB when Note 2 in Table 6.2.2A-1 applies to the serving cell *c*, otherwise  $\Delta T_{C,c} = 0$  dB.

For each subframe, the  $P_{CMAX_L}$  is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX_L}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured maximum output power P<sub>UMAX</sub> over all serving cells shall be within the following range:

 $P_{CMAX\_L} - MAX\{T_L, T_{LOW}(P_{CMAX\_L})\} \leq P_{UMAX} \leq P_{CMAX\_H} + T_{HIGH}(P_{CMAX\_H})$ 

 $P_{UMAX} = 10 \log_{10} \sum p_{UMAX,c}$ 

where  $p_{UMAX,c}$  denotes the measured maximum output power for serving cell *c* expressed in linear scale. The tolerances  $T_{LOW}(P_{CMAX})$  and  $T_{HIGH}(P_{CMAX})$  for applicable values of  $P_{CMAX}$  are specified in Table 6.2.5A-2 for intra-band carrier

aggregation. The tolerance  $T_L$  is the absolute value of the lower tolerance for applicable E-UTRA CA configurations as specified in Table 6.2.2A-1 for intra-band contiguous carrier aggregation.

P <sub>CMAX</sub> (dBm)	Tolerance T <sub>Low</sub> (P <sub>CMAX</sub> ) (dB)	Tolerance Т <sub>нібн</sub> (Р <sub>СМАХ</sub> ) (dB)
$21 \le P_{CMAX} \le 23$	2.0	)
20 ≤ P <sub>CMAX</sub> < 21	2.5	5
19 ≤ P <sub>CMAX</sub> < 20	3.5	5
18 ≤ P <sub>CMAX</sub> < 19	4.(	)
13 ≤ P <sub>CMAX</sub> < 18	5.0	)
8 ≤ P <sub>CMAX</sub> < 13	6.0	)
-40 ≤ P <sub>CMAX</sub> < 8	7.(	)

Table 6.2.5A-2: PCMAX tolerance for dual uplink intra-band contiguous CA

#### Table 6.2.5A-3: Void

## 6.2.5B Configured transmitted power for UL-MIMO

For UE supporting UL-MIMO, the transmitted power is configured per each UE.

The definitions of configured maximum output power  $P_{CMAX,c}$ , the lower bound  $P_{CMAX\_L,c}$ , and the higher bound  $P_{CMAX\_L,c}$  specified in subclause 6.2.5 shall apply to UE supporting UL-MIMO, where

- $P_{PowerClass}$  and  $\Delta T_{C,c}$  are specified in subclause 6.2.2B;
- MPR<sub>c</sub> is specified in subclause 6.2.3B;
- A-MPR<sub>c</sub> is specified in subclause 6.2.4B.

The measured configured maximum output power  $P_{UMAX,c}$  for serving cell c shall be within the following bounds:

 $P_{CMAX\_L,c} - MAX\{T_L, T_{LOW}(P_{CMAX\_L,c})\} \leq P_{UMAX,c} \leq P_{CMAX\_H,c} + T_{HIGH}(P_{CMAX\_H,c})$ 

where  $T_{LOW}(P_{CMAX\_L,c})$  and  $T_{HIGH}(P_{CMAX\_H,c})$  are defined as the tolerance and applies to  $P_{CMAX\_L,c}$  and  $P_{CMAX\_H,c}$  separately, while  $T_L$  is the absolute value of the lower tolerance in Table 6.2.2B-1 for the applicable operating band.

For UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2.5B-1. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2.

Table 6.2.5B-1: PCMAX,c tolerance in closed-loop spatial multiplexing scheme

Р <sub>смах,с</sub> (dBm)	ToleranceToleranceTLOW(PCMAX_L,c) (dB)THIGH(PCMAX_H,c) (dB)				
$P_{CMAX,c} = 23$	3.0	2.0			
22 ≤ P <sub>CMAX,c</sub> < 23	5.0	2.0			
21 ≤ P <sub>CMAX,c</sub> < 22	5.0	3.0			
$20 \le P_{CMAX,c} < 21$	6.0	4.0			
16 ≤ P <sub>CMAX,c</sub> < 20	5.0				
11 ≤ P <sub>CMAX,c</sub> < 16	6.0				
-40 ≤ P <sub>CMAX,c</sub> < 11	7.	.0			

For single-antenna port scheme, the requirements in subclause 6.2.5 apply.

## 6.3 Output power dynamics

## 6.3.1 (Void)

## 6.3.2 Minimum output power

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

#### 6.3.2.1 Minimum requirement

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.1-1.

	Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	-40 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

#### Table 6.3.2.1-1: Minimum output power

## 6.3.2A UE Minimum output power for CA

For intra-band contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., the power in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

#### 6.3.2A.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation the minimum output power is defined as the mean power in one subframe (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2A.1-1.

Table 6.3.2A.1-1: Minimum output power for intra-band contiguous CA UE

	CC Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4         3.0         5         10         15         20           MHz         MHz         MHz         MHz         MHz         MHz					-
Minimum output power	-40 dBm					
Measurement bandwidth				9.0 MHz	13.5 MHz	18 MHz

## 6.3.2B UE Minimum output power for UL-MIMO

For UE supporting UL-MIMO, the minimum controlled output power is defined as the broadband transmit power of the UE, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) at each transmit antenna connector, when the UE power is set to a minimum value.

## 6.3.2B.1 Minimum requirement

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2B.1-1.

	Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	-40 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

Table 6.3.2B	.1-1: Minimum	output p	ower
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For single-antenna port scheme, the requirements in subclause 6.3.2 apply.

## 6.3.3 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

#### 6.3.3.1. Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3.1-1.

	Channel bandwidth / Transmit OFF power / Measurement bandwidth					
	1.4         3.0         5         10         15         20           MHz         MHz         MHz         MHz         MHz         MHz					-
Transmit OFF power	-50 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

Table 6.3.3.1-1: Transmit OFF power

## 6.3.3A UE Transmit OFF power for CA

For intra-band contiguous carrier aggregation, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on both component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During measurements gaps, the UE is not considered to be OFF.

## 6.3.3A.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation the transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3A.1-1.

	Channel bandwidth / Transmit OFF power / Measurement bandwidth					
	1.4         3.0         5         10         15         20           MHz         MHz         MHz         MHz         MHz         MHz					
Transmit OFF power	-50 dBm					
Measurement bandwidth				9.0 MHz	13.5 MHz	18 MHz

Table 6.3.3A.1-1: Transmit OFF power for intra-band contiguous CA UE

## 6.3.3B UE Transmit OFF power for UL-MIMO

For UE supporting UL-MIMO, the transmit OFF power is defined as the mean power at each transmit antenna connector when the transmitter is OFF at all transmit antenna connectors. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

#### 6.3.3B.1 Minimum requirement

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3.3B.1-1.

	Channel bandwidth / Transmit OFF power/ Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Transmit OFF power	-50 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

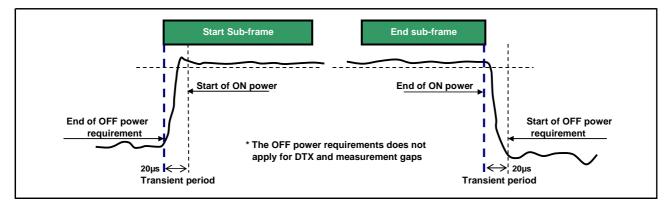
 Table 6.3.3B.1-1: Transmit OFF power per antenna port

## 6.3.4 ON/OFF time mask

## 6.3.4.1 General ON/OFF time mask

The General ON/OFF time mask defines the observation period between Transmit OFF and ON power and between Transmit ON and OFF power. ON/OFF scenarios include; the beginning or end of DTX, measurement gap, contiguous, and non contiguous transmission

The OFF power measurement period is defined in a duration of at least one sub-frame excluding any transient periods. The ON power is defined as the mean power over one sub-frame excluding any transient period.





## 6.3.4.2 PRACH and SRS time mask

#### 6.3.4.2.1 PRACH time mask

The PRACH ON power is specified as the mean power over the PRACH measurement period excluding any transient periods as shown in Figure 6.3.4.2-1. The measurement period for different PRACH preamble format is specified in Table 6.3.4.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

PRACH preamble format	Measurement period (ms)
0	0.9031
1	1.4844
2	1.8031
3	2.2844
4	0.1479

Table 6.3.4.2-1: PRACH ON power measurement period

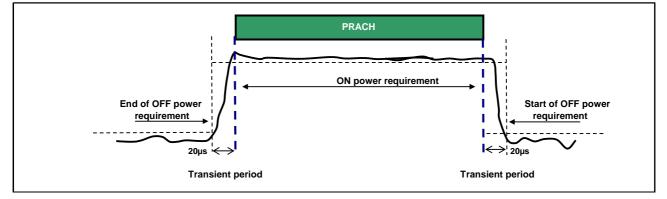


Figure 6.3.4.2-1: PRACH ON/OFF time mask

#### 6.3.4.2.2 SRS time mask

In the case a single SRS transmission, the ON power is defined as the mean power over the symbol duration excluding any transient period. Figure 6.3.4.2.2-1

In the case a dual SRS transmission, the ON power is defined as the mean power for each symbol duration excluding any transient period. Figure 6.3.4.2.2-2

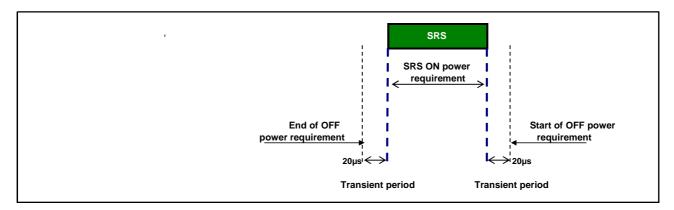


Figure 6.3.4.2.2-1: Single SRS time mask

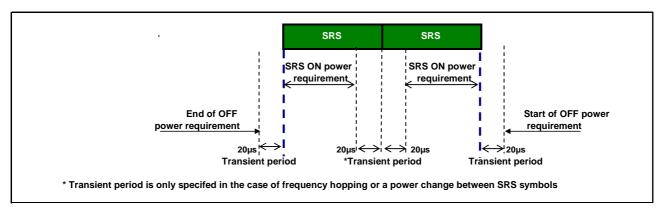


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

### 6.3.4.3 Slot / Sub frame boundary time mask

The sub frame boundary time mask defines the observation period between the previous/subsequent sub–frame and the (reference) sub-frame. A transient period at a slot boundary within a sub-frame is only allowed in the case of Intra-sub frame frequency hopping. For the cases when the subframe contains SRS the time masks in subclause 6.3.4.4 apply.

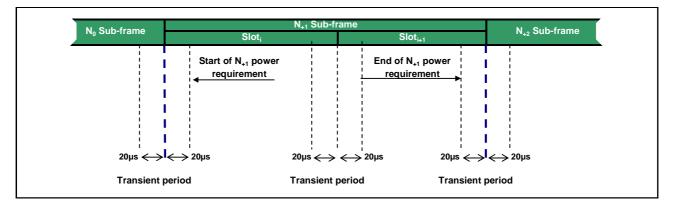


Figure 6.3.4.3-1: Transmission power template

## 6.3.4.4 PUCCH / PUSCH / SRS time mask

The PUCCH/PUSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PUSCH/PUCCH symbol and subsequent sub-frame.

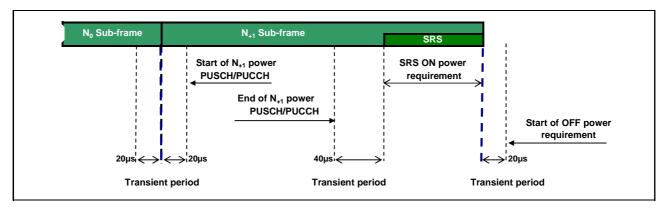


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

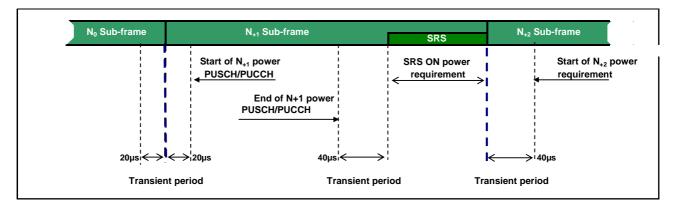


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

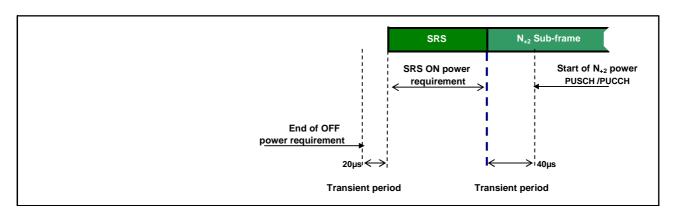
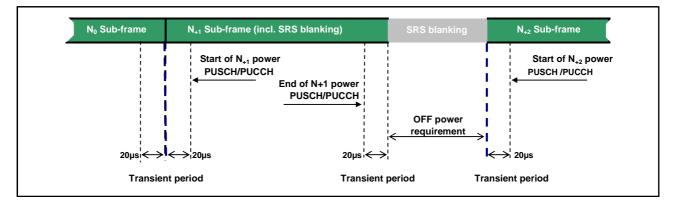
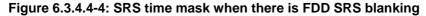


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before





## 6.3.4A ON/OFF time mask for CA

For intra-band contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.4.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.4.1 shall only be applicable for each component carrier when all the component carriers are OFF.

## 6.3.4B ON/OFF time mask for UL-MIMO

For UE supporting UL-MIMO, the ON/OFF time mask requirements in subclause 6.3.4 apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.4.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.3.4 apply.

## 6.3.5 Power Control

#### 6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133)

In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

#### 6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under Note 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within  $F_{UL\_low}$  and  $F_{UL\_low} + 4$  MHz or  $F_{UL\_high} - 4$  MHz and  $F_{UL\_high}$ .

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

#### Table 6.3.5.1.1-1: Absolute power tolerance

#### 6.3.5.2 Relative Power tolerance

The relative power tolerance is the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is  $\leq 20$  ms.

For PRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4.2-1.

#### 6.3.5.2.1 Minimum requirements

The requirements specified in Table 6.3.5.2.1-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2 and the measured PUMAX as defined in subclause 6.2.5 (i.e, the actual power as would be measured assuming no measurement error). This power shall be within the power limits specified in subclause 6.2.5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.2 and 6.2.2. For these exceptions the power tolerance limit is a maximum of  $\pm 6.0$  dB in Table 6.3.5.2.1-1

Power step ∆P (Up or down) [dB]		All combinations of PUSCH and PUCCH transitions [dB]	All combinations of PUSCH/PUCCH and SRS transitions between sub- frames [dB]	PRACH [dB]
ΔP < 2		±2.5 (Note 3)	±3.0	±2.5
2 ≤ ∆P <	3	±3.0	±4.0	±3.0
3 ≤ ∆P <	4	±3.5	±5.0	±3.5
4 ≤ ∆P ≤ <sup>•</sup>	10	±4.0	±6.0	±4.0
10 ≤ ∆P <	15	±5.0	±8.0	±5.0
15 ≤ ΔP		±6.0	±9.0	±6.0
NOTE 2: Fe to tra Fi su th Fi re ra df NOTE 3: Fe fix by	NOTE 1: For extreme conditions an additional ± 2.0 dB relaxation is allowed			

#### Table 6.3.5.2.1-1 Relative power tolerance for transmission (normal conditions)

The power step ( $\Delta P$ ) is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames with the power setting according to subclause 5.1 of [TS 36.213]. The error is the difference

between  $\Delta P$  and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5.2.1-1.

For sub-frames not containing an SRS symbol, the power change is defined as the relative power difference between the mean power of the original reference sub-frame and the mean power of the target subframe not including transient durations. The mean power of successive sub-frames shall be calculated according to Figure 6.3.4.3-1 and Figure 6.3.4.1-1 if there is a transmission gap between the reference and target sub-frames.

If at least one of the sub-frames contains an SRS symbol, the power change is defined as the relative power difference between the mean power of the last transmission within the reference sub-frame and the mean power of the first transmission within the target sub-frame not including transient durations. A transmission is defined as PUSCH, PUCCH or an SRS symbol. The mean power of the reference and target sub-frames shall be calculated according to Figures 6.3.4.1-1, 6.3.4.2-1, 6.3.4.4-1, 6.3.4.4-2 and 6.3.4.4-3 for these cases.

#### 6.3.5.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant.

#### 6.3.5.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2.

TPC command UL channel		Aggregate power tolerance within 21 ms	
0 dB	PUCCH	±2.5 dB	
0 dB PUSCH		±3.5 dB	
NOTE: The UE transmission gap is 4 ms. TPC command is transmitted via PDCCH 4 subframes preceding each PUCCH/PUSCH transmission.			

Table 6.3.5.3.1-1: Aggregate power control tolerance

## 6.3.5A Power control for CA

The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per component carrier with power setting in accordance with Clause 5.1 of [6].

#### 6.3.5A.1 Absolute power tolerance

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

#### 6.3.5A.1.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth classe C the absolute power control tolerance per component carrier is given in Table 6.3.5.1.1-1.

## 6.3.5A.2 Relative power tolerance

#### 6.3.5A.2.1 Minimum requirements

The requirements apply when the power of the target and reference sub-frames on each component carrier exceed -20 dBm and the total power is limited by  $P_{UMAX}$  as defined in subclause 6.2.5A. For the purpose of these requirements, the power in each component carrier is specified over only the transmitted resource blocks.

For intra-band contiguous carrier aggregation bandwidth classe C, the UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.5.2.1-1:

b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.5.2.1-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subrames:

c) for RACH on the primary component carrier, the requirements given in Table 6.3.5.2.1-1 for PRACH

For a) and b) above, the power step  $\Delta P$  between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

For a), b) and c) above, two exceptions are allowed for each component carrier for a power per carrier ranging from -20 dBm to  $P_{UMAX,c}$  as defined in subclause 6.2.5. For these exceptions the power tolerance limit is ±6.0 dB in Table 6.3.5.2.1-1..

## 6.3.5A.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in [6] are constant on all active component carriers.

#### 6.3.5A.3.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth classe C, the aggregate power tolerance per component carrier is given in Table 6.3.5.3.1-1 with either simultaneous PUSCH or simultaneous PUCCH-PUSCH (if supported by the UE) configured. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

## 6.3.5B Power control for UL-MIMO

For UE supporting UL-MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.5 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2, wherein

- The Maximum output power requirements for UL-MIMO are specified in subclause 6.2.2B
- The Minimum output power requirements for UL-MIMO are specified in subclause 6.3.2B
- The requirements for configured transmitted power for UL-MIMO are specified in subclause 6.2.5B.

For single-antenna port scheme, the requirements in subclause 6.3.5 apply.

## 6.4 Void

## 6.5 Transmit signal quality

## 6.5.1 Frequency error

The UE modulated carrier frequency shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B

## 6.5.1A Frequency error for CA

For intra-band contiguous carrier aggregation the UE modulated carrier frequencies per band shall be accurate to within  $\pm 0.1$  PPM observed over a period of one timeslot compared to the carrier frequency of primary component carrier received from the E-UTRA in the corresponding band.

## 6.5.1B Frequency error for UL-MIMO

For UE(s) supporting UL-MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

## 6.5.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.5.2 are defined using the measurement methodology specified in Annex F.

## 6.5.2.1 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and is one slot for the PUCCH and PUSCH in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the EVM measurement interval is reduced by one symbol, accordingly. The PUSCH or PUCCH EVM measurement interval is also reduced when the mean power, modulation or allocation between slots is expected to change. In the case of PUSCH transmission, the measurement interval is reduced by a time interval equal to the sum of 5  $\mu$ s and the applicable exclusion period defined in subclause 6.3.4, adjacent to the boundary where the power change is expected to occur. The PUSCH exclusion period is applied to the signal obtained after the front-end IDFT. In the case of PUCCH transmission with power change, the PUCCH EVM measurement interval is reduced by one symbol adjacent to the boundary where the power change is expected to occur.

#### 6.5.2.1.1 Minimum requirement

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, [all PRACH preamble formats 0-4 and] all PUCCH formats 1, 1a, 1b, 2, 2a and 2b are considered to have the same EVM requirement as QPSK modulated.

#### Table 6.5.2.1.1-1: Minimum requirements for Error Vector Magnitude

F	Parameter	Unit	Average EVM Level	Reference Signal EVM Level
QPSK or BPS	Κ	%	17.5	17.5
16QAM		%	12.5	12.5

#### Table 6.5.2.1.1-2: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ -40
Operating conditions		Normal conditions

#### 6.5.2.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

#### 6.5.2.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

Parameters	Relative limit (dBc)	Applicable frequencies
Output power >10 dBm	-28	Carrier center frequency < 1 GHz
	-25	Carrier center frequency ≥ 1 GHz
0 dBm ≤ Output power ≤10 dBm	-25	
-30 dBm ≤ Output power ≤0 dBm	-20	
-40 dBm ≤ Output power < -30 dBm	-10	

## 6.5.2.3 In-band emissions

The in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non–allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

#### 6.5.2.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2.3.1-1.

Parameter description	Unit	Limit (Note 1)		Applicable Frequencies
		$\max\{ -25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}), $		
General	dB	$20 \cdot \log_{10} EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB}$ ,		Any non-allocated (Note 2)
		- 57	$7 dBm / 180 kHz - P_{RB}$	(1006 2)
		-28	Image frequencies when carrier center frequency < 1 GHz and Output power > 10 dBm	Imaga
IQ Image	dB	-25	Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm	Image frequencies
		-25	Image frequencies when carrier center frequency ≥ 1 GHz	(Notes 2, 3)
		-28	Output power > 10 dBm and carrier center frequency < 1 GHz	
Carrier leakage	dBc	-25	Output power > 10 dBm and carrier center frequency ≥ 1 GHz	Carrier frequency (Notes 4, 5)
leakaye		-25	0 dBm ≤ Output power ≤10 dBm	(110185 4, 5)
		-20 -10	-30 dBm ≤ Output power ≤ 0 dBm -40 dBm ≤ Output power < -30 dBm	
<ul> <li>NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.</li> <li>NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated RBs.</li> <li>NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.</li> <li>NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC</li> </ul>				
frequency if $N_{RB}$ is odd, or in the two RBs immediately adjacent to the DC frequency if $N_{RB}$ is even, but excluding any allocated RB. NOTE 6: $L_{CRB}$ is the Transmission Bandwidth (see Figure 5.6-1).				
NOTE 7: $N_{RB}$ is the Transmission Bandwidth Configuration (see Figure 5.6-1).				
NOTE 8: $EVM$ is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs. NOTE 9: $\Delta_{RB}$ is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.				
$\Delta_{_{RB}}=1$ or $\Delta_{_{RB}}=-1$ for the first adjacent RB outside of the allocated bandwidth.				
NOTE 10: $P_{RB}$ is the transmitted power per 180 kHz in allocated RBs, measured in dBm.				

#### Table 6.5.2.3.1-1: Minimum requirements for in-band emissions

### 6.5.2.4 EVM equalizer spectrum flatness

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex F) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block. The basic measurement interval is the same as for EVM.

#### 6.5.2.4.1 Minimum requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.5.2.4.1-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.5.2.4.1-1).

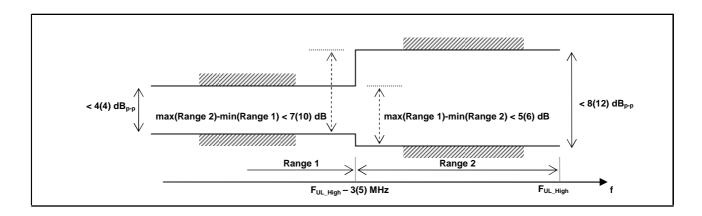
The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.5.2.4.1-1).

Table 6.5.2.4.1-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

	Frequency range	Maximum ripple [dB]
F <sub>UL_Mea</sub>	s – $F_{UL\_Low} \ge 3 \text{ MHz}$ and $F_{UL\_High} - F_{UL\_Meas} \ge 3 \text{ MHz}$	4 (p-p)
	(Range 1)	
F <sub>UL_Mea</sub>	as – F <sub>UL_Low</sub> < 3 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 3 MHz	8 (p-p)
	(Range 2)	
NOTE 1:	$F_{\text{UL}\_\text{Meas}}$ refers to the sub-carrier frequency for which evaluated	the equalizer coefficient is
NOTE 2:	$F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency 5.5-1	band specified in Table

Table 6.5.2.4.1-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

Frequency range	Maximum Ripple [dB]
$F_{UL_Meas} - F_{UL_Low} \ge 5 \text{ MHz and } F_{UL_High} - F_{UL_Meas} \ge 5 \text{ MHz}$	4 (p-p)
(Range 1)	
F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> < 5 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 5 MHz	12 (p-p)
(Range 2)	
NOTE 1: FUL_Meas refers to the sub-carrier frequency for which	the equalizer coefficient is
evaluated	
NOTE 2: FUL_Low and FUL_High refer to each E-UTRA frequence	/ band specified in Table
5.5-1	



## Figure 6.5.2.4.1-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement within brackets).

## 6.5.2A Transmit modulation quality for CA

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

#### 6.5.2A.1 Error Vector Magnitude

For the intra-band contiguous carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers. Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.5.2.1.

When a single component carrier is configured Table 6.5.2.1.1-1 apply.

The EVM requirements are according to Table 6.5.2A.1-1 if CA is configured in uplink.

Parameter	Unit	Average EVM Level per CC	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5

Table 6.5.2A.1-1: Minimum requirements for Error Vector Magnitude

### 6.5.2A.2 Carrier leakage for CA

Carrier leakage is an additive sinusoid waveform that is confined within the aggregated transmission bandwidth configuration. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

#### 6.5.2A.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2A.2.1-1.

#### Table 6.5.2A.2.1-1: Minimum requirements for Relative Carrier Leakage Power

Parameters	Relative Limit (dBc)
Output power >0 dBm	-25
-30 dBm ≤ Output power ≤0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

### 6.5.2A.3 In-band emissions

#### 6.5.2A.3.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation bandwidth class C, the requirements in Table 6.5.2A.3.1-1 and 6.5.2A.3.1-2 apply within the aggregated transmission bandwidth configuration with both component carrier (s) active and one single contiguous PRB allocation of bandwidth  $L_{CRB}$  at the edge of the aggregated transmission bandwidth configuration.

The inband emission is defined as the interference falling into the non allocated resource blocks for all component carriers. The measurement method for the inband emissions in the component carrier with PRB allocation is specified in annex F. For a non allocated component carrier a spectral measurement is specified.

Parameter	Unit		Limit	Applicable Frequencies					
General	dB	$20\cdot \log_{10}$	$25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$ $/ 180  kHz - P_{RB} \}$	Any non-allocated (Note 2)					
IQ Image	dB		-25	Exception for IQ image (Note 3)					
Carrier leakage	dBc	-25 -20 -10	Output power > 0 dBm -30 dBm ≤ Output power ≤ 0 dBm -40 dBm ≤ Output power < -30 dBm	Exception for Carrier frequency (Note 4)					
mi (G no NOTE 2:The all	<ul> <li>NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of <i>P<sub>RB</sub></i> - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. <i>P<sub>RB</sub></i> is defined in Note 9. The limit is evaluated in each non-allocated RB.</li> <li>NOTE 2:The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs</li> </ul>								
NOTE 3: Ex	ceptions to the g	eneral limit are	e allowed for up to $ L_{{\it CRBs}}$ +1 RBs within	a contiguous width of $L_{\it CRBs}$ +1					
NOTE 4: Ex ba	ceptions to the g	eneral limit are and the limit is	ment bandwidth is 1 RB. allowed for up to two contiguous non-a expressed as a ratio of measured powe ted RBs.						
NOTE 5: $L$	<sub>CRB</sub> is the Transr	nission Bandw	vidth (see Figure 5.6-1) not exceeding	$N_{RB}/2-1$					
	$V_{RB}$ is the Transmocated.	iission Bandwi	dth Configuration (see Figure 5.6-1) of t	the component carrier with RBs					
		specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs. g frequency offset between the allocated RB and the measured non-allocated RB (e.g.							
Δ	$_{\scriptscriptstyle RB}=1$ or $\Delta_{\scriptscriptstyle RB}=$	= -1 for the fi	rst adjacent RB outside of the allocated	bandwidth).					
NOTE 9: <i>P</i>	$_{RB}$ is the transmit	ted power per	180 kHz in allocated RBs, measured in	dBm.					

Para- meter	Unit	Meas BW Note 1		Limit	remark	Applicable Frequencies				
General	dB	BW of 1 RB (180KHz rectangular)	$20 \cdot \log_{10}$	$25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$ $h / 180  kHz - P_{RB} \}$	The reference value is the average power per allocated RB in the allocated component carrier	Any RB in the non allocated component carrier. The frequency raster of the RBs is derived when this component carrier is allocated with RBs				
IQ Image	dB	BW of 1 RB (180KHz rectangular)		-25 Note 2	The reference value is the average power per allocated RB in the allocated component carrier	The frequencies of the $L_{CRB}$ contiguous non-allocated RBs are unknown. The frequency raster of the RBs is derived when this component carrier is allocated with RBs				
		BW of 1 RB		Note 3	The	The				
		(180KHz rectangular)	-25	Output power > 0 dBm	reference value is the total power	frequencies of the up to 2 non-allocated				
Carrier leakage	dBc		-20	-30 dBm ≤ Output power ≤ 0 dBm	of the allocated RBs in the allocated component carrier	RBs are unknown. The frequency raster of the RBs is derived when this				
			-10	-40 dBm ≤ Output power < -30 dBm		component carrier is allocated with RBs				
	Resolutio		han the me	asurement BW may be integrated	to achieve the r	neasurement				
NOTE 2: I	Exception	is to the general	limit is are	allowed for up to $L_{\rm CRB}$ +1 RBs wit	hin a contiguou	is width of $L_{{\scriptscriptstyle CRB}}$				
NOTE 3: T NOTE 4: I	+1 non-allocated RBs. NOTE 3: Two Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs NOTE 4: Notes 1, 5, 6, 7, 8, 9 from Table 6.5.2A.3.1-1 apply for Table 6.5.2A.3.1-2 as well.									

### Table 6.5.2A.3.1-2: Minimum requirements for in-band emissions (not allocated component carrier)

values when the carrier spacing between the CCs is not a multiple of RB.

#### 6.5.2B Transmit modulation quality for UL-MIMO

For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna connector.

For single-antenna port scheme, the requirements in subclause 6.5.2 apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)

- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

### 6.5.2B.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.5.2.1.1-1 which is defined in subclause 6.5.2.1 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.5.2.2.1-1 which is defined in subclause 6.5.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.5.2.3.1-1 which is defined in subclause 6.5.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.4 EVM equalizer spectrum flatness for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.5.2.4.1-1 and Table 6.5.2.4.1-2 which are defined in subclause 6.5.2.4 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

## 6.6 Output RF spectrum emissions

The output UE transmitter spectrum consists of the three components; the emission within the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

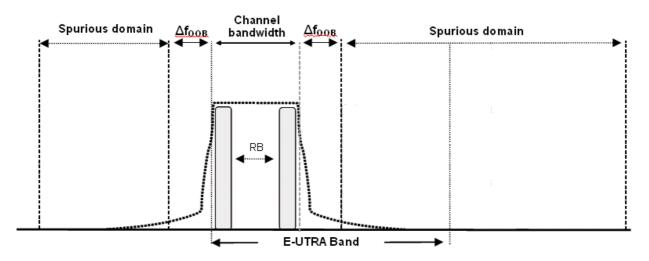


Figure 6.6-1: Transmitter RF spectrum

## 6.6.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.6.1-1

	Occupied channel bandwidth / Channel bandwidth						
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Channel bandwidth (MHz)	1.4	3	5	10	15	20	

Table 6.6.1-1: Occupied channel bandwidth

## 6.6.1A Occupied bandwidth for CA

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.6A.

## 6.6.1B Occupied bandwidth for UL-MIMO

For UE supporting UL-MIMO, the requirements for occupied bandwidth is specified at each transmit antenna connector. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in Table 6.6.1B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

	Occupied channel bandwidth / Channel bandwidth					
	1.4 3.0 5 10 15 20					
	MHz	MHz	MHz	MHz	MHz	MHz
Channel bandwidth (MHz)	1.4	3	5	10	15	20

Table 6.6.1B-1: Occupied channel bandwidth

For single-antenna port scheme, the requirements in subclause 6.6.1 apply.

## 6.6.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio.

### 6.6.2.1 Spectrum emission mask

The spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the ± edge of the assigned E-UTRA channel bandwidth. For frequencies greater than ( $\Delta f_{OOB}$ ) as specified in Table 6.6.2.1.1-1 the spurious requirements in subclause 6.6.3 are applicable.

#### 6.6.2.1.1 Minimum requirement

The power of any UE emission shall not exceed the levels specified in Table 6.6.2.1.1-1 for the specified channel bandwidth.

	Spectrum emission limit (dBm)/ Channel bandwidth									
Δf <sub>оов</sub> (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth			
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz			
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz			
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz			
± 2.8-5		-10	-10	-10	-10	-10	1 MHz			
± 5-6		-25	-13	-13	-13	-13	1 MHz			
± 6-10			-25	-13	-13	-13	1 MHz			
± 10-15				-25	-13	-13	1 MHz			
± 15-20					-25	-13	1 MHz			
± 20-25						-25	1 MHz			

Table 6.6.2.1.1-1: General E-UTRA spectrum emission mask

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.2.1A Spectrum emission mask for CA

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the ± edge of the aggregated channel bandwidth (Table 5.6A-1) For intra-band contiguous carrier aggregation the bandwidth class C, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.1A-1 for the specified channel bandwidth.

Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>								
Δf <sub>OOB</sub>	25RB+100RB	50RB+100RB	75RB+75RB	75RB+100RB	100RB+100RB	Measurement		
(MHz)	(24.95 MHz)	(29.9 MHz)	(30 MHz)	(34.85 MHz)	(39.8 MHz)	bandwidth		
± 0-1	-22	-22.5	-22.5	-23.5	-24	30 kHz		
± 1-5	-10	-10	-10	-10	-10	1 MHz		
± 5-24.95	-13	-13	-13	-13	-13	1 MHz		
± 24.95-29.9	-25	-13	-13	-13	-13	1 MHz		
$\pm 29.9-29.95$	-25	-25	-13	-13	-13	1 MHz		
± 29.95-30		-25	-13	-13	-13	1 MHz		
± 30-34.85		-25	-25	-13	-13	1 MHz		
$\pm$ 34.85-34.9		-25	-25	-25	-13	1 MHz		
± 34.9-35			-25	-25	-13	1 MHz		
± 35-39.8				-25	-13	1 MHz		
$\pm$ 39.8-39.85				-25	-25	1 MHz		
± 39.85-44.8					-25	1 MHz		

#### Table 6.6.2.1A-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C

#### 6.6.2.2 Additional spectrum emission mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

#### 6.6.2.2.1 Minimum requirement (network signalled value "NS\_03", "NS\_11", and "NS\_20")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_03", "NS\_11" or "NS\_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.1-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δf <sub>оов</sub> (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth		
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz		
± 1-2.5	-13	-13	-13	-13	-13	-13	1 MHz		
± 2.5-2.8	-25	-13	-13	-13	-13	-13	1 MHz		
± 2.8-5		-13	-13	-13	-13	-13	1 MHz		
± 5-6		-25	-13	-13	-13	-13	1 MHz		
± 6-10			-25	-13	-13	-13	1 MHz		
± 10-15				-25	-13	-13	1 MHz		
± 15-20					-25	-13	1 MHz		
± 20-25						-25	1 MHz		

Table 6.6.2.2.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

#### 6.6.2.2.2 Minimum requirement (network signalled value "NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.2-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δf <sub>oob</sub> (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth		
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz		
± 1-2.5	-13	-13	-13	-13	-13	-13	1 MHz		
± 2.5-2.8	-25	-13	-13	-13	-13	-13	1 MHz		
± 2.8-5.5		-13	-13	-13	-13	-13	1 MHz		
± 5.5-6		-25	-25	-25	-25	-25	1 MHz		
± 6-10			-25	-25	-25	-25	1 MHz		
± 10-15				-25	-25	-25	1 MHz		
± 15-20					-25	-25	1 MHz		
± 20-25						-25	1 MHz		

Table 6.6.2.2.2-1: Additional requirements

Note: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

#### 6.6.2.2.3 Minimum requirement (network signalled value "NS\_06" or "NS\_07")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_06" or "NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.3-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δf <sub>OOB</sub> (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	Measurement bandwidth				
± 0-0.1	-13	-13	-15	-18	30 kHz				
± 0.1-1	-13	-13	-13	-13	100 kHz				
± 1-2.5	-13	-13	-13	-13	1 MHz				
± 2.5-2.8	-25	-13	-13	-13	1 MHz				
± 2.8-5		-13	-13	-13	1 MHz				
± 5-6		-25	-13	-13	1 MHz				
± 6-10			-25	-13	1 MHz				
± 10-15				-25	1 MHz				

#### Table 6.6.2.2.3-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.2.2A Additional Spectrum Emission Mask for CA

This requirement is specified in terms of an "additional spectrum emission" requirement.

#### 6.6.2.2A.1 Minimum requirement (network signalled value "CA\_NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "CA\_NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2A-1.

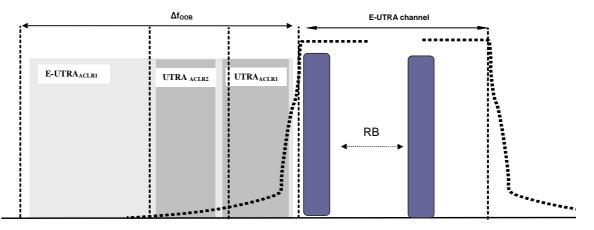
	Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>						
Δf <sub>OOB</sub> (MHz)	50+100RB (29.9 MHz)	75+75B (30 MHz)	75+100RB (34.85 MHz)	100+100RB (39.8 MHz)	Measurement bandwidth		
± 0-1	-22.5	-22.5	-23.5	-24	30 kHz		
± 1-5.5	-13	-13	-13	-13	1 MHz		
± 5.5-34.9	-25	-25	-25	-25	1 MHz		
± 34.9-35		-25	-25	-25	1 MHz		
$\pm$ 35-39.85			-25	-25	1 MHz		
± 39.85-44.8				-25	1 MHz		

#### Table 6.6.2.2A-1: Additional requirements

Note: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.2.3 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirements for one E-UTRA carrier are specified for two scenarios for an adjacent E-UTRA and /or UTRA channel as shown in Figure 6.6.2.3-1.





#### 6.6.2.3.1 Minimum requirement E-UTRA

E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2. If the measured adjacent channel power is greater than -50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2.

	Char	Channel bandwidth / E-UTRA <sub>ACLR1</sub> / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
E-UTRA <sub>ACLR1</sub>	30 dB	30 dB	30 dB	30 dB	30 dB	30 dB	
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz	
Adjacent channel	+1.4	+3.0	+5	+10	+15	+20	
centre frequency	/	/	/	/	/	/	
offset [MHz]	-1.4	-3.0	-5	-10	-15	-20	

Table 6.6.2.3.1-1: General requirements for E-UTRA<sub>ACLR</sub>

	Char	Channel bandwidth / E-UTRA <sub>ACLR1</sub> / Measurement bandwidth				
	1.4	3.0	5	10	15	20
	MHz	MHz	MHz	MHz	MHz	MHz
E-UTRA <sub>ACLR1</sub>			37 dB	37 dB		
E-UTRA channel						
Measurement			4.5 MHz	9.0 MHz		
bandwidth						
Adjacent channel			+5	+10		
centre frequency			/	/		
offset [MHz]			-5	-10		
NOTE 1: E-UTRA <sub>ACLR1</sub> shall be applicable for >23dBm						

### 6.6.2.3.1A Void

#### 6.6.2.3.2 Minimum requirements UTRA

UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned E-UTRA channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA<sub>ACLR1</sub>) and the 2<sup>nd</sup> UTRA adjacent channel (UTRA<sub>ACLR2</sub>). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha$  =0.22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2-1. If the measured UTRA channel power is greater than –50dBm then the UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.2-1.

		Channel bandwidth / UTRA <sub>ACLR1/2</sub> / Measurement bandwidth					
	1.4	3.0	5	10	15	20	
	MHz	MHz	MHz	MHz	MHz	MHz	
UTRA <sub>ACLR1</sub>	33 dB	33 dB	33 dB	33 dB	33 dB	33 dB	
Adjacent channel centre	0.7+BW <sub>UTRA</sub> /2 / -0.7-	1.5+BW <sub>UTRA</sub> /2	+2.5+BW <sub>UTRA</sub> /2 /	+5+BW <sub>UTRA</sub> /2 /	+7.5+BW <sub>UTRA</sub> /2 /	+10+BW <sub>UTRA</sub> /2 /	
frequency offset [MHz]	-0.7- BW <sub>UTRA</sub> /2	-1.5- BW <sub>UTRA</sub> /2	-2.5-BW <sub>UTRA</sub> /2	-5-BW <sub>UTRA</sub> /2	-7.5-BW <sub>UTRA</sub> /2	-10-BW <sub>UTRA</sub> /2	
UTRA <sub>ACLR2</sub>	-	-	36 dB	36 dB	36 dB	36 dB	
Adjacent channel centre frequency offset [MHz]	-	-	+2.5+3*BW <sub>UTRA</sub> /2 / -2.5-3*BW <sub>UTRA</sub> /2	+5+3*BW <sub>UTRA</sub> /2 / -5-3*BW <sub>UTRA</sub> /2	+7.5+3*BW <sub>UTRA</sub> /2 / -7.5-3*BW <sub>UTRA</sub> /2	+10+3*BW <sub>UTRA</sub> /2 / -10-3*BW <sub>UTRA</sub> /2	
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz	
UTRA 5MHz channel Measurement bandwidth (Note 1)	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	
UTRA 1.6MHz channel measurement bandwidth (Note 2)	1.28 MHz	1.28 MHz	1.28 MHz	1.28MHz	1.28MHz	1.28MHz	

Table 6.6.2.3.2-1: Rec	uirements for	UTRA <sub>ACLR1/2</sub>
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### 6.6.2.3.2A Minimum requirement UTRA for CA

For intra-band contiguous carrier aggregation the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA<sub>ACLR1</sub>) and the 2<sup>nd</sup> UTRA adjacent channel (UTRA<sub>ACLR2</sub>). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha$  =0.22. The assigned aggregated channel bandwidth power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2A-1. If the measured UTRA channel power is greater than –50dBm then the UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.2A-1.

	CA bandwidth class / UTRA <sub>ACLR1/2</sub> / measurement bandwidth			
	CA bandwidth class C			
UTRA <sub>ACLR1</sub>	33 dB			
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> /2 + BW <sub>UTRA</sub> /2 / - BW <sub>Channel_CA</sub> / 2 - BW <sub>UTRA</sub> /2			
UTRA <sub>ACLR2</sub>	36 dB			
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> /2 + 3*BW <sub>UTRA</sub> /2 / - BW <sub>Channel_CA</sub> /2 - 3*BW <sub>UTRA</sub> /2			
CA E-UTRA channel Measurement bandwidth	BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>			
UTRA 5MHz channel Measurement bandwidth (Note 1)	3.84 MHz			
UTRA 1.6MHz channel measurement bandwidth (Note 2)	1.28 MHz			
NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.				

#### Table 6.6.2.3.2A-1: Requirements for UTRA<sub>ACLR1/2</sub>

#### 6.6.2.3.3A Minimum requirements for CA E-UTRA

For intra-band contiguous carrier aggregation the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-1. If the measured adjacent channel power is greater than – 50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.3A-1.

Table 6.6.2.3.3A-1: General re	quirements for CA E-UTRA <sub>ACLR</sub>
--------------------------------	------------------------------------------

	CA bandwidth class / CA E-UTRA <sub>ACLR</sub> / Measurement bandwidth CA bandwidth class C
CA E-UTRA <sub>ACLR</sub>	30 dB
CA E-UTRA channel Measurement bandwidth	BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>
Adjacent channel centre frequency offset (in MHz)	+ BW <sub>Channel_CA</sub> / - BW <sub>Channel_CA</sub>

6.6.2.4 Void

6.6.2.4.1 Void

## 6.6.2A Void

<reserved for future use>

## 6.6.2B Out of band emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.6.3 apply.

## 6.6.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements inline with SM.329 [2] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.3.1 Minimum requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.6.3.1-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

#### Table 6.6.3.1-1: Boundary between E-UTRA out of band and spurious emission domain

Channel bandwidth	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
OOB	2.8	6	10	15	20	25
boundary F <sub>OOB</sub> (MHz)						

Frequency Range	Maximum Level	Measurement bandwidth	Note
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12.75 GHz	-30 dBm	1 MHz	
12.75 GHz ≤ f < 5 <sup>th</sup> harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	1
NOTE 1: Applies for Bar	nd 22, Band 42 and	Band 43	

#### Table 6.6.3.1-2: Spurious emissions limits

### 6.6.3.1A Minimum requirements for CA

This clause specifies the spurious emission requirements for carrier aggregation.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth (Table 5.6A-1). For

frequencies  $\Delta$ fOOB greater than FOOB as specified in Table 6.6.3.1A-1the spurious emission requirements in Table 6.6.3.1-2 are applicable.

#### Table 6.6.3.1A-1: Boundary between E-UTRA out of band and spurious emission domain for intraband contiguous carrier aggregation

CA Bandwidth Class	ООВ boundary F <sub>оов</sub> (MHz)
A	Table 6.6.3.1-1
В	FFS
C	BW <sub>Channel_CA</sub> + 5

### 6.6.3.2 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

	Spurious emission							
E-UTRA Band	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note	
1	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 41, 42, 43, 44	F <sub>DL low</sub>	_	$F_{DL_high}$	-50	1		
	E-UTRA Band 3, 34	FDL_low	-	FDL_high FDL_high	-50	1	15	
	Frequency range	1880		1895	-40	1	15,27	
	Frequency range	1895		1915	-15.5	5	15, 26, 27	
	Frequency range	1915		1920	+1.6	5	15, 26, 27	
	Frequency range	1839.9	-	1879.9	-50	1	15	
2	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, 41, 42	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1		
	E-UTRA Band 2, 25	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15	
	E-UTRA Band 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
3	E-UTRA Band 1, 7, 8, 20, 26, 27, 28, 33, 34, 38, 41, 43, 44	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1		
	E-UTRA Band 3	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	15	
	E-UTRA Band 11, 18, 19, 21	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	13	
	E-UTRA Band 22, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
4	Frequency range	1884.5	-	1915.7	-41	0.3	13	
4	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 41, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1		
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
5	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 28, 29,42, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1		
	E-UTRA Band 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
-	E-UTRA Band 26	859	-	869	-27	1		
6	E-UTRA Band 1, 9, 11, 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1		
	Frequency range	860	-	875	-37	1		
	Frequency range	875 1884.5	-	895 1919.6	-50	0.3	7	
	Frequency range	1884.5	-	1915.7		010	8	
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1		
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26	
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26	
	Frequency range	2595	-	2620	-40	1	15, 21	
8	E-UTRA Band 1, 20, 28, 33, 34, 38, 39, 40	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1		
	E-UTRA band 3	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	2	
	E-UTRA band 7	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	2	
	E-UTRA Band 8	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	15	
	E-UTRA Band 22, 41, 42, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	2	
	E-UTRA Band 11, 21	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	23	
	Frequency range	860	-	890	-40	1	15, 23	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 23	
9	E-UTRA Band 1, 11, 18, 19, 21, 26, 28, 34	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1		
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
	Frequency range	1884.5	-	1915.7	-41	0.3	8	
	Frequency range	945	-	960	-50	1		
	Frequency range	1839.9	-	1879.9	-50	1		
10	Frequency range E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	2545	-	2575	-50	1		
10	23, 24, 25, 26, 27, 28, 29, 41, 43		-	F <sub>DL_high</sub>	-50	1	2	
11	E-UTRA Band 22, 42 E-UTRA Band 1, 11, 18, 19, 21, 28, 34,	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	2	
	42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	-	
	Frequency range	1884.5	-	1915.7	-41	0.3	8	

## Table 6.6.3.2-1: Requirements

	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	2545	-	2575	-50	1	
12	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 41	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	E-UTRA Band 4, 10	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	2
	E-UTRA Band 12	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 26, 27, 29, 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	_	805	-35	0.00625	11, 15
	E-UTRA Band 14	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 24	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1	2
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 41	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	769	-	775	-35	0.00625	12, 15
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
17	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 41	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	E-UTRA Band 4, 10	F <sub>DL low</sub>	-	$F_{DL_high}$	-50	1	2
	E-UTRA Band 12	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
18	E-UTRA Band 1, 11, 21, 34, 42	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	860	-	890	-40	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	_	1879.9	-50	1	
	Frequency range	2545	_	2575	-50	1	
19	E-UTRA Band 1, 11, 21, 28, 34, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
	Frequency range	2545	-	2575	-50	1	
20	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34, 40, 43	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	E-UTRA Band 20	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	15
	E-UTRA Band 38, 42	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	2
	Frequency range	758	-	788	-50	1	
21	E-UTRA Band 1, 18, 19, 28, 34, 42	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9 2545	-	1879.9 2575	-50 -50	1	
22	Frequency range E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28,	2040	-	2075			
	33, 34, 38, 39, 40, 43	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	Frequency range	3510	-	3525	-40	1	15
	Frequency range	3525	-	3590	-50	1	
23	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, 41	F <sub>DL low</sub>	-	F <sub>DL high</sub>	-50	1	
24	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, 41	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	
25	E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 41, 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 2	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 25	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 43	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	2
26	E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29,			DE_nigh	-50	1	
	34, 40, 42, 43	$F_{DL\_low}$	-	$F_{DL_high}$			
	E-UTRA Band 41	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	703	-	799	-50	1	
		799	-	803	-40	1	15
		945		960	-50	1	1

	Frequency range	1839.9	-	1879.9	-50	1	
27	E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13, 14, 17, 23, 25, 26, 27, 29, 38, 41, 42, 43	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	Frequency range	799	-	805	-35	0.00625	
	E-UTRA Band 28	F <sub>DL_low</sub>	-	790	-50	1	
28	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 25, 26, 27, 34, 38, 41	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
	E-UTRA Band 1, 4, 10, 22, 42, 43	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	2
	E-UTRA Band 11, 21	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	19, 24
	E-UTRA Band 1	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	19, 25
	Frequency range	470	-	694	-42	8	15, 32
	Frequency range	470	-	710	-26.2	6	31
	Frequency range	758	-	773	-32	1	15
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	15
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 19
	Frequency range	1839.9	-	1879.9	-50	1	
33	E-UTRA Band 1, 7, 8, 20, 22, 28, 34, 38, 40, 42, 43	F <sub>DL_low</sub>	-	$F_{DL_{high}}$	-50	1	5
	E-UTRA Band 3	F <sub>DL_low</sub>	-	F <sub>DL high</sub>	-50	1	15
34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 28, 33, 38,39, 40, 41, 42, 43, 44	F <sub>DL_low</sub>	_	F <sub>DL_high</sub>	-50	1	5
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	1839.9	-	1879.9	-50	1	Ŭ
35							
36							
37			-				
38	E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22
39	E-UTRA Band 22, 34, 40, 41, 42, 44	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
40	E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 28, 33, 34, 38, 39, 41, 42, 43, 44	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
41	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 34, 39, 40, 42, 44	F <sub>DL low</sub>	-	$F_{DL_{high}}$	-50	1	
	E-UTRA Band 9, 11, 18, 19, 21	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	30
	Frequency range	1839.9		1879.9	-50	1	30
	Frequency range	1884.5		1915.7	-41	0.3	8, 30
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11, 18, 19, 20, 21, 25, 26, 27, 28, 33, 34, 38, 40, 41, 44	F <sub>DL_low</sub>	_	F <sub>DL_high</sub>	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 22	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	[-50]	[1]	3
44	E-UTRA Band 3, 5, 8, 34, 39, 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 1, 40, 42	F <sub>DL_low</sub>		F <sub>DL_high</sub>	-50	1	2

NOTE 1: FDL\_low and FDL\_high refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3, 4, [5] for the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval. NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band NOTE 4: N/A NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band NOTE 6: N/A. NOTE 7: Applicable when co-existence with PHS system operating in 1884.5-1919.6MHz. NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz. NOTE 9: N/A. NOTE 10: N/A. NOTE 11: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB NOTE 13: This requirement applies for 5, 10, 15 and 20 MHz E-UTRA channel bandwidth allocated within 1744.9MHz and 1784.9MHz. NOTE 14: N/A. NOTE 15: These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth. NOTE 16: N/A. NOTE 17: N/A NOTE 18: N/A NOTE 19: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. NOTE 20: N/A. NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 22: This requirement is applicable for any channel bandwidths within the range 2570 - 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 - 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers with channel bandwidth overlapping the frequency range 2615 - 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE *P-Max*. NOTE 23 This requirement is applicable only for the following cases: - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is within the range 902.5 MHz  $\leq$  F<sub>c</sub> < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is within the range 907.5 MHz  $\leq$  F<sub>c</sub>  $\leq$  912.5 MHz without any restriction on uplink transmission bandwidth. - for carriers of 10 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is F<sub>c</sub> = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with  $RB_{start} > 3$ . NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 2<sup>nd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3<sup>rd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3<sup>rd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band. NOTE 27: This requirement is applicable for any channel bandwidths within the range 1920 - 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 - 1938 MHz the requirement is applicable only for an uplink

	ansmission bandwidth less than or equal to 54 RB.
NOTE 28: N/	
NOTE 29: N/	/A.
	his requirement applies when the E-UTRA carrier is confined within 2545-2575 MHz and the nannel bandwidth is 10 or 20 MHz.
72	his requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718- 28MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission andwidth less than or equal to 30 RB with RBstart > 1 and RBstart<48.
ar	his requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz nd 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz oplies.

## 6.6.3.2A Spurious emission band UE co-existence for CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

E- Spurious emission							
UTRA CA Config uration	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
CA_1C	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 41, 42, 43, 44	F <sub>DL_low</sub>	-	$F_{DL_{high}}$	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
CA_7C	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
CA_38C	E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
CA_40C	E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 33, 34, 38, 39, 41, 42, 43, 44	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
CA_41C	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 34, 39, 40, 42, 44	F <sub>DL low</sub>	-	$F_{DL_{high}}$	-50	1	
NOTE 1: NOTE 2: NOTE 4:	6.6.3.1-2 are permitted for each assigned $4^{th}$ [or $5^{th}$ ] harmonic spurious emissions is also allowed for the first 1 MHz freque both sides of the harmonic emission. The harmonic emission of (2MHz + N x L <sub>CRB</sub> harmonic respectively. The exception is partially overlaps the overall exception i restriction will be needed for either the comparison of the second secon	vel up to th ed E-UTRA . Due to sp ency range nis results i x 180kHz) allowed if nterval. NC	e ap cai read imr n ar , wh the DTE	oplicable re rier used i ding of the nediately of overall ex nere N is 2 measurem 3: To mee	equirements de n the measurer harmonic emis outside the harm ception interva , 3, 4, [5] for th nent bandwidth et these require	efined in Ta ment due t ssion the e monic emis al centred a e 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 (MBW) tot	o $2^{nd}$ , $3^{rd}$ , xception ssion on at the $4^{th}$ [or $5^{th}$ ] cally or
NOTE 4: NOTE 5: NOTE 6: NOTE 7: NOTE 8: NOTE 9:	N/A N/A N/A N/A						
	The requirement also applies for the fre 6.6.3.1-1 and Table 6.6.3.1A-1 from the						ible
	For these adjacent bands, the emission UE(s) operating in the protected operati		imp	oly risk of h	armful interfer	ence to	

### 6.6.3.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

### 6.6.3.3.1 Minimum requirement (network signalled value "NS\_05")

When "NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)			Measurement bandwidth	Note	
	5 MHz	10 MHz	15 MHz	20 MHz		
1884.5 ≤ f ≤1915.7	-41	-41	-41	-41	300 KHz	1
NOTE 1: Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is larger than or equal to the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as defined in subclause 5.6. Additional restrictions apply for operations below this point.						

Table 6.6.3.3.1-1: A	dditional rec	uirements (	(PHS)
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The requirements in Table 6.6.3.3.1-1 apply with the additional restrictions specified in Table 6.6.3.3.1-2 when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is less than the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned.

Table 6.6.3.3.1-2: RB restrictions for additional requirement (PHS).

15 MHz channel bandwidth with $f_c$ = 1932.5 MHz						
RB <sub>start</sub> 0-7 8-66 67-74						
L <sub>CRB</sub>	N/A	≤ MIN(30, 67 – RB <sub>start</sub> )	N/A			
	20 MHz channel ba	andwidth with $f_c = 1930 \text{ MHz}$	Z			
RB <sub>start</sub>	0-23	24-75	76-99			
L <sub>CRB</sub>	N/A	≤ MIN(24, 76 – RB <sub>start</sub> )	N/A			

### 6.6.3.3.2 Minimum requirement (network signalled value "NS\_07")

When "NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.2-1:	Additional	requirements
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Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth			
	10 MHz				
769 ≤ f ≤ 775	-57	6.25 kHz			
NOTE: The emissions measurement shall be sufficiently power averaged to ensure standard standard deviation < 0.5 dB.					

#### 6.6.3.3.3 Minimum requirement (network signalled value "NS\_08")

When "NS 08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.3-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band	Channel ban	Measurement bandwidth		
(MHz)	(MHz) 5MHz 10MHz 15MHz			
860 ≤ f ≤ 890	-40	-40	-40	1 MHz

Table 6.6.3.3.3-1: Additional requirement

#### 6.6.3.3.4 Minimum requirement (network signalled value "NS\_09")

When "NS 09" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.4-1: Additional requirement

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)			Measurement bandwidth
	5MHz	10MHz	15MHz	
1475.9 ≤ f ≤ 1510.9	-35	-35	-35	1 MHz

NOTE 1: Void

NOTE 2: To improve measurement accuracy, A-MPR values for NS\_09 specified in Table 6.2.4-1 in subclause 6.2.4 are derived based on 100 kHz RBW.

#### 6.6.3.3.5 Minimum requirement (network signalled value "NS\_12")

When "NS 12" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	1.4 MHz, 3 MHz, 5 MHz	
806 ≤ f ≤ 813.5	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower channel above 814.2 MHz.		nnel edge at or
NOTE 2: The emissions standard devia	measurement shall be sufficiently power averation < 0.5 dB.	aged to ensure a

### 6.6.3.3.6 Minimum requirement (network signalled value "NS\_13")

When "NS 13" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.6-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5 MHz	Measurement bandwidth	
806 ≤ f ≤ 816	-42	6.25 kHz	
NOTE 1: The requirement applies for E-UTRA carriers with lower channel above 819 MHz.		nnel edge at or	
NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure standard deviation < 0.5 dB.		aged to ensure a	

Table 6.6.3.3.6-1: Additional requirements

### 6.6.3.3.7 Minimum requirement (network signalled value "NS\_14")

When "NS 14" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.7-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz, 15 MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower chan above 824 MHz.		nnel edge at or
NOTE 2: The emissions measurement shall be sufficiently power averaged to extended deviation < 0.5 dB.		aged to ensure a

Table 6.6.3.3.7-1: Additional requirements

### 6.6.3.3.8 Minimum requirement (network signalled value "NS\_15")

When "NS 15" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.8-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table	6.6.3.3.	8-1:	Additional	requirements
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Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz	Measurement bandwidth
851 ≤ f ≤ 859	-53	6.25 kHz
NOTE 1: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

### 6.6.3.3.9 Minimum requirement (network signalled value "NS\_16")

When "NS\_16" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.9-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10 MHz	Measurement bandwidth	Note
790 ≤ f ≤ 803	-32	1 MHz	

#### Table 6.6.3.3.9-1: Additional requirements

### 6.6.3.3.10 Minimum requirement (network signalled value "NS\_17")

When "NS\_17" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.10-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10 MHz	Measurement bandwidth	Note	
470 ≤ f ≤ 710	-26.2	6 MHz	1	
NOTE 1: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.				

#### Table 6.6.3.3.10-1: Additional requirements

### 6.6.3.3.11 Minimum requirement (network signalled value "NS\_18")

When "NS\_18" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.11-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.11-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth	Note
692-698	-26.2	6 MHz	

#### 6.6.3.3.12 Minimum requirement (network signalled value "NS\_19")

When "NS\_19" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.12-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 3, 5, 10, 15, 20 MHz	Measurement bandwidth	Note
662 ≤ f ≤ 694	-25	8 MHz	

### 6.6.3.3.13 Minimum requirement (network signalled value "NS\_11")

When "NS\_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.13-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10, 15, 20 MHz	Measurement bandwidth
E-UTRA Band 2	-50	1 MHz
1998 ≤ f ≤ 1999	-21	1 MHz
1997 ≤ f < 1998	-27	1 MHz
1996 ≤ f < 1997	-32	1 MHz
1995 ≤ f < 1996	-37	1 MHz
1990 ≤ f < 1995	-40	1 MHz

Table 6.6.3.3.13-1: Additional requirements

### 6.6.3.3.14 Minimum requirement (network signalled value " NS\_20")

When "NS\_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.14-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth					
1990 ≤ f < 1999	-40	1 MHz					
1999 ≤ f ≤ 2000	-40	Note 1					
Note 1: The measurement bandwidth is 1% of the applicable E-UTRA channel bandwidth.							

Table 6.6.3.3.14-1: Additional requirements

### 6.6.3.3.15 Minimum requirement (network signalled value " NS\_22")

When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.15-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

	ency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	MBW			
0.400						
3400	≤ f ≤ 3800	-23 (Note 1, Note 3)	5 MHz			
		-40 (Note 2)	1 MHz			
Note 1:	Note 1: This requirement applies within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.					
Note 2:	te 2: This requirement applies from 3400 MHz to 25 MHz below the lower E- UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge to 3800 MHz.					
Note 3:		limit might imply risk of harmful interference to ed operating band.	o UE(s) operating			

Table 6.6.3.3.15-1: Additional requirement

### 6.6.3.3.16 Minimum requirement (network signalled value "NS\_23")

When "NS 23" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.16-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	MBW						
	5, 10, 15, 20 MHz							
3400 ≤ f ≤ 3800	-23 (Note 1, Note 4)	5 MHz						
	-40 (Note 2)	1 MHz						
NOTE 1: This requiren	nent applies within an offset between 5 MHz +	- F <sub>offset NS 23</sub>						
and 25 MHz	+ $F_{offset_NS_{23}}$ from the lower and from the upper	er edges of						
the channel b	andwidth, whenever these frequencies overlap	with the						
specified free	juency band.							
NOTE 2: This requiren	nent applies from 3400 MHz to 25 MHz $+$ F <sub>off</sub>	fset NS 23						
below the low	ver E-UTRA channel edge and from 25 MHz -	F						
F <sub>offset_NS_23</sub> ab	ove the upper E-UTRA channel edge to 3800	MHz.						
NOTE 3: F <sub>offset_NS_23</sub> is:								
0 MHz for 5	MHz channel BW,							
5 MHz for 10	) MHz channel BW,							
9 MHz for 15	5 MHz channel BW and							
12 MHz for 2	12 MHz for 20 MHz channel BW.							
NOTE 4: This emission	n limit might imply risk of harmful interference	e to UE(s)						
operating in t	he protected operating band							

Table 6.6.3.3.16-1: Additional requirement

### 6.6.3.3A Additional spurious emissions for CA

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell reconfiguration message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

## 6.6.3.3A.1 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_01")

When "CA\_NS\_01" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note		
E-UTRA band 34	FDL_low	-	FDL_high	-50	1			
Frequency range	1884.5	ŀ	1915.7	-41	0.3	1		
NOTE 1: Applicable when the aggregated channel bandwidth is confined within frequency range 1940 – 1980 MHz								

### 6.6.3.3A.2 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_02")

When "CA\_NS\_02" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note		
E-UTRA band 34	F <sub>DL_low</sub> - F <sub>DL_high</sub>			-50	1			
Frequency range	1900	I	1915	-15.5	5	1, 2		
Frequency range	1915	-	1920	+1.6	5	1, 2		
NOTE 1: The requirement also applies for the frequency ranges that are less than F <sub>OOB</sub> (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth. NOTE 2 <sup>:</sup> For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.								

Table 6.6.3.3A.2-1: Additional requirements

### 6.6.3.3A.3 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_03")

When "CA\_NS\_03" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.3-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note		
E-UTRA band 34	$F_{DL_{low}}$	I	$F_{DL_high}$	-50	1			
Frequency range	1880	I	1895	-40	1			
Frequency range	1895	I	1915	-15.5	5	1, 2		
Frequency range	Frequency range 1915 - 1920			+1.6	5	1, 2		
<ul> <li>NOTE 1: The requirement also applies for the frequency ranges that are less than F<sub>OOB</sub> (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.</li> <li>NOTE 2<sup>i</sup> For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.</li> </ul>								

Table 6.6.3.3A.3-1: Additional requirements

### 6.6.3.3A.4 Minimum requirement for CA\_38C (network signalled value "CA\_NS\_05")

When "CA\_NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth. This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570 - 2615 MHz.

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
Frequency range	2620	-	2645	-15.5	5	1, 2, 3
Frequency range	2645	-	2690	-40	1	1, 3
Table 6.6 NOTE 2 For these UE(s) op NOTE 3: This requ	3.3.1-1 and T adjacent ba erating in the	able ands, e prot	6.6.3.1A-1 fi the emission ected operation	equency ranges that are le rom the edge of the chanr n limit could imply risk of h ting band. ers with aggregated chanr	el bandwidth. armful interfere	nce to

Table 6.6.3.3A.4-1: Additional	requirements
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### 6.6.3.3A.5 Minimum requirement for CA\_7C (network signalled value "CA\_NS\_06")

When "CA\_NS\_06" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note		
Frequency range	2570	I	2575	+1.6	5	1, 2		
Frequency range	2575	-	2595	-15.5	5	1,2		
Frequency range	2595	-	2620	-40	1			
(MHz) ir	NOTE 1: The requirement also applies for the frequency ranges that are less than F <sub>OOB</sub> (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.							
NOTE 2 <sup>:</sup> For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.								

Table 6.6.3.3A.5-1: Additional requirements

## 6.6.3A Void

<reserved for future use>

## 6.6.3B Spurious emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.3 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-1.

For single-antenna port scheme, the general requirements in subclause 6.6.3 apply.

## 6.6A Void

## 6.6B Void

## 6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

## 6.7.1 Minimum requirement

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through E-UTRA rectangular filter with measurement bandwidth shown in Table 6.7.1-1.

The requirement of transmitting intermodulation is prescribed in Table 6.7.1-1.

BW Channel (UL)	5MHz		10MHz		15MHz		20MHz			
Interference Signal Frequency Offset	5MHz	10MHz	10MHz	20MHz	15MHz	30MHz	20MHz	40MHz		
Interference CW Signal Level		-40dBc								
Intermodulation Product	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc		
Measurement bandwidth	4.5MHz	4.5MHz	9.0MHz	9.0MHz	13.5MHz	13.5MHz	18MHz	18MHz		

Table 6.7.1-1: Transmit Intermodulation

## 6.7.1A Minimum requirement for CA

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product on both component carriers when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1A-1.

For intra-band contiguous carrier aggregation the requirement of transmitting intermodulation is specified in Table 6.7.1A-1.

CA bandwidth class(UL)		С
Interference Signal Frequency Offset	BW <sub>Channel_CA</sub>	2*BW <sub>Channel_CA</sub>
Interference CW Signal Level	-40	0dBc
Intermodulation Product	-29dBc	-35dBc
Measurement bandwidth	BW <sub>Channel</sub>	<sub>CA</sub> - 2* BW <sub>GB</sub>

Table 6.7.1A-1: Transmit Intermodulation

## 6.7.1B Minimum requirement for UL-MIMO

For UE supporting UL-MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.7.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.7.1 apply.

- 6.8 Void
- 6.8.1 Void
- 6.8A Void

## 6.8B Time alignment error for UL-MIMO

For UE(s) with multiple transmit antenna connectors supporting UL-MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

## 6.8B.1 Minimum Requirements

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

# 7 Receiver characteristics

## 7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sections below.

With the exception of subclause 7.3, the requirements shall be verified with the network signalling value NS\_01 configured (Table 6.2.4-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers (one component carrier per sub-block), an in-gap test refers to the case when the interfering signalis located at a negative offset with respect to the assigned channel frequency of the highest carrier frequency and located at a positive offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers (one component carrier per sub-block), an out-of-gap test refers to the case when the interfering signal(s) is (are) located at a positive offset with respect to the assigned channel frequency of the highest carrier frequency, or located at a negative offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers with channel bandwidth larger than or equal to 5 MHz (one component carrier per sub-block), the existing adjacent channel selectivity requirements, in-band blocking requirements (for each case), and narrow band blocking requirements apply for in-gap tests only if the corresponding interferer frequency offsets with respect to the two measured carriers satisfy the following condition in relation to the sub-block gap size  $W_{gap}$  for at least one of these carriers j, j = 1,2, so that the interferer frequency position does not change the nature of the core requirement tested:

 $W_{gap} \geq 2 \cdot |F_{Interferer \; (offset),j}| - BW_{Channel(j)}$ 

where  $F_{\text{Interferer (offset)},j}$  is the interferer frequency offset with respect to carrier *j* as specified in subclause 7.5.1, subclause 7.6.1 and subclause 7.6.3 for the respective requirement and BW<sub>Channel(j)</sub> the channel bandwidth of carrier *j*. The interferer frequency offsets for adjacent channel selectivity, each in-band blocking case and narrow- band blocking shall be tested separately with a single in-gap interferer at a time.

## 7.2 Diversity characteristics

The requirements in Section 7 assume that the receiver is equipped with two Rx port as a baseline. These requirements apply to all UE categories unless stated otherwise. Requirements for 4 ports are FFS. With the exception of subclause 7.9 all requirements shall be verified by using both (all) antenna ports simultaneously.

## 7.3 Reference sensitivity power level

The reference sensitivity power level REFSENS is the minimum mean power applied to both the UE antenna ports at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

## 7.3.1 Minimum requirements (QPSK)

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2

		Ch	annel bar	ndwidth			
E-UTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex
Band	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	Mode
1			-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6			-100	-97			FDD
7			-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD
9			-99	-96	-94.2	-93	FDD
10			-100	-97	-95.2	-94	FDD
11			-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14			-97	-94			FDD
17			-97	-94			FDD
18			-100 <sup>7</sup>	-97 <sup>7</sup>	-95.2 <sup>7</sup>		FDD
19			-100	-97	-95.2		FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97	-95.2	-94	FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
26	-102.7	-99.7	-97.5 <sup>6</sup>	-94.5 <sup>6</sup>	-92.7 <sup>6</sup>		FDD
27	-103.2	-100.2	-98	-95			FDD
28		-100.2	-98.5	-95.5	-93.7	-91	FDD
33			-100	-97	-95.2	-94	TDD
34			-100	-97	-95.2		TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37			-100	-97	-95.2	-94	TDD
38			-100	-97	-95.2	-94	TDD
39			-100	-97	-95.2	-94	TDD
40			-100	-97	-95.2	-94	TDD
41			-98	-95	-93.2	-92	TDD
42			-99	-96	-94.2	-93	TDD
43			-99	-96	-94.2	-93	TDD
44		[-100.2]	[-98]	[-95]	[-93.2]	[-92]	TDD
	The transmitter						
	Reference meas Pattern OP.1 FD						NG
	The signal powe					۲.۱	
	For the UE whic				d 9 the ref	erence sen	sitivity
ŀ	evel is FFS.						
	For the UE whic evel is FFS.	h supports	both Band	11 and Ba	ind 21 the i	eference s	ensitivity
	indicates that the	he reauirem	nent is mo	dified bv -0	.5 dB wher	the carrie	r
f	requency of the	assigned E	E-UTRA cl	hannel ban	dwidth is w	ithin 865-8	94 MHz.
NOTE 7: F	For a UE that su	pport both	Band 18 a	and Band 2	6, the refer		
f	or Band 26 app	lies for the	applicable	e channel ba	andwidths.		

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1-1 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1-2.

NOTE: Table 7.3.1-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

For the UE which supports inter-band carrier aggregation configuration in Table 7.3.1-1A with uplink in one E-UTRA band, the minimum requirement for reference sensitivity in Table 7.3.1-1 shall be increased by the amount given in  $\Delta R_{IB,c}$  in Table7.3.1-1A for the applicable E-UTRA bands.

Inter-band CA Configuration	E-UTRA Band	ΔR <sub>IB,c</sub> [dB]
	1	0
CA_1A-5A	5	0
CA_1A-18A	1	0
CA_1A-16A	18	0
CA_1A-19A	1	0
07_17-137	19	0
CA_1A-21A	1	0
	21	0
CA_2A-17A	2	0
	17	0.5
CA_3A-5A	3	0
	3	0
CA_3A-7A	7	0
	3	0
CA_3A-8A	8	0
<u> </u>	3	0
CA_3A-20A	20	0
	4	0
CA_4A-5A	5	0
CA_4A-7A	4	0.5
0/(_4/////	7	0.5
CA_4A-12A	4	0
	12	0.5
CA_4A-13A	4	0
_	13	0
CA_4A-17A	4	0
	<u> </u>	0.5
CA_5A-12A	12	0.3
	5	0.5
CA_5A-17A	17	0.3
0.0.70.000	7	0
CA_7A-20A	20	0
	8	0
CA_8A-20A	20	0
CA_11A-18A	11	0
	18	0
bands configu NOTE 2: The ab	ove additional tolerances are only ap that belong to the supported inter-bar urations ove additional tolerances also apply i	n intra-band CA and non-
aggreg the sup	pated operation for the supported E-U oported inter-band carrier aggregation the UE supports more than one of the	TRA operating bands that belong to configurations
aggreg one int	ation configurations and a E-UTRA o er-band carrier aggregation configura hen the E-UTRA operating band freq	perating band belongs to more than tions then:
	plicable additional tolerance shall be	
Ta	ble 7.3.1-1A, truncated to one decimerating band among the supported CA	al place that would apply for that
ha	rmonic relation between low band Ul aximum tolerance among the differen	L and high band DL, then the
со	nfigurations involving such band sha	ll be applied
ap	hen the E-UTRA operating band freq plicable additional tolerance shall be 3.1-1A that would apply for that oper	the maximum tolerance in Table

Table 7.3.1-1A: ΔR<sub>IB,c</sub>

CA configurations

NOTE : The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

E-UTRA Band 1 2 3	1.4 MHz	3 MHz	5 MHz	ndwidth / I 10 MHz	15 MHz	20 MHz	<u> </u>
1 2				10 10112	13 1411 12		Duplex Mode
			25	50	75	100	FDD
3	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
4	6	15	25	50	75	100	FDD
5	6	15	25	25 <sup>1</sup>			FDD
6			25	25 <sup>1</sup>			FDD
7			25	50	75	75 <sup>1</sup>	FDD
8	6	15	25	25 <sup>1</sup>			FDD
9			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
10			25	50	75	100	FDD
11			25	25 <sup>1</sup>			FDD
12	6	15	20 <sup>1</sup>	20 <sup>1</sup>			FDD
13			20 <sup>1</sup>	20 <sup>1</sup>			FDD
14			15 <sup>1</sup>	15 <sup>1</sup>			FDD
17			20 <sup>1</sup>	20 <sup>1</sup>			FDD
18			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
19			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
20			25	20 <sup>1</sup>	20 <sup>3</sup>	20 <sup>3</sup>	FDD
21			25	25 <sup>1</sup>	25 <sup>1</sup>		FDD
22			25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
23	6	15	25	50	75	100	FDD
24	Ű		25	50		100	FDD
25	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD
26	6	15	25	25 <sup>1</sup>	25 <sup>1</sup>	00	FDD
27	6	15	25	25 <sup>1</sup>	20		FDD
28	0	15	25	25 <sup>1</sup>	25 <sup>1</sup>	25 <sup>1</sup>	FDD
		10	20	20	20	20	100
33			25	50	75	100	TDD
34			25	50	75	100	TDD
35	6	15	25	50	75	100	TDD
36	6	15	25	50	75	100	TDD
37	0	10	25	50	75	100	TDD
38		ļ	25	50	75	100	TDD
39			25	50	75	100	TDD
40		ļ	25	50	75	100	TDD
41			25	50	75	100	TDD
42		ļ	25	50	75	100	TDD
43			25	50	75	100	TDD
44		15	25	50	75	100	TDD
NOTE 1: 1 t NOTE 2: F NOTE 3: 3	refers to th he downlink bandwidth c For the UE to configuration refers to Ba resource blo channel ban	e UL resc operating onfiguration which sup on for refer and 20; in ocks shall	purce bloc g band bu on for the ports both ence sens the case be located	ks shall be t confined channel ba Band 11 a sitivity is FF of 15MHz d at RB <sub>start</sub>	located as within the t andwidth (1 and Band 2 S. channel ba 11 and in t	close as p ransmissio able 5.6-1) 1 the uplin ndwidth, th he case of	ossible to n ). k e UL 20MHz

 Table 7.3.1-2: Uplink configuration for reference sensitivity

Unless given by Table 7.3.1-3, the minimum requirements specified in Tables 7.3.1-1 and 7.3.1-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

E-UTRA Band	Network Signalling value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03

Table 7.3.1-3: Network signalling value for reference sensitivity
-------------------------------------------------------------------

## 7.3.1A Minimum requirements (QPSK) for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2. The reference sensitivity is defined to be met with both downlink component carriers active and either of the uplink carriers active. The UE shall meet the requirements specified in subclause 7.3.1 with the following exceptions.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0a, exceptions to the aforementioned requirements are allowed when the uplink active in the lower-frequency operating band is within a specified frequency range as noted in Table 7.3.1A-0a. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0a and Table 7.3.1A-0b.

			Channel ba	andwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
CA_3A-8A <sup>4</sup>	3				N/A	N/A	N/A	FDD
CA_SA-6A	8			N/A	N/A			гии
CA_4A-12A <sup>5,6</sup>	4	-89.2	-89.2	-90	-89.5			FDD
CA_4A-12A	12			-96.5	-93.5			FUU
CA_4A-17A <sup>5,6</sup>	4			-90	-89.5			FDD
NOTE 1: The ti	17			-96.5	-93.5			FDD
NOTE 3: The s NOTE 4: No re bandw transmot th NOTE 5: These transm down NOTE 6: The re $f_{UL}^{LB}$	TDD as desc ignal power i quirements a width of the k mission band e case (the r e requirement mission band link transmiss equirements = $\left[ f_{DL}^{HB} / 0.3 \right] 0$ r frequency of	ribed in Annex s specified pe	A.5.1.1/A. r port re is at lease inch the 2nd gh band. The pecified in there is at w band for n of the high fied for UL $F_{UL_{-low}}^{LB} + B$	5.2.1 st one indi d transmitt he referen clause 7.3 least one which the band. EARFCN $W_{Channel}^{LB}/2$	vidual RE vidua	within the u c is within t ity is only v RE within th itter harmo pand (supe $f_{high} - BW_{Ch}^{LI}$	plink transn he downlini erified when ne uplink nic is withir rscript LB) s annet/2 with	hission this is the such that $f_{DL}^{HB}$ the

Table 7.3.1A-0a: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions)
-----------------------------------------------------------------------------------------------

E-UTRA Band / Channel bandwidth of the high band / $N_{RB}$ / Duplex mode											
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode			
CA_4A-12A	12	2	5	8	16			FDD			
CA_4A-17A	17			8	16			FDD			
config NOTE 2: the U resou	CA_4A-17A       17       8       16       FDD         NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.       NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.										

Table 7.3.1A-0b: Uplink configuration for the low band (exceptions)

For band combinations including operating bands without uplink band (as noted in Table 5.5-1), the requirements are specified in Table 7.3.1A-0d and Table 7.3.1A-0e.

Channel bandwidth										
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode		
CA 2A-29A	2			-98	-95			FDD		
CA_ZA-Z9A	29		-98.7	-97	-94			FDD		
	4			-100	-97					
CA_4A-29A	29		-98.7	-97	-94			FDD		
NOTE 1: The transmitter shall be set to P <sub>UMAX</sub> as defined in subclause 6.2.5A.         NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1         FDD/TDD as described in Annex A.5.1.1/A.5.2.1         NOTE 3: The signal power is specified per port										

Table 7.3.1A-0d: Reference sensitivity QPSK PREFSENS

Table 7.3.1A-0e:	<b>Uplink configuration</b>	for reference sensitivity
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E-UTRA Band / Channel bandwidth / NRB / Duplex mode										
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode		
	2			25	50					
CA_2A-29A	29		N/A	N/A	N/A			FDD		
	4			25	50					
CA_4A-29A	29		N/A	N/A	N/A			FDD		

In all cases for single uplink inter-band CA, unless given by Table 7.3.1-3 for the band with the active uplink carrier, the applicable reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

For intra-band contiguous carrier aggregation the throughput of each component carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1A-1. Table 7.3.1A-1 specifies the maximum number of allocated uplink resource blocks for which the intra-band contiguous carrier aggregation reference sensitivity requirement shall be met. The PCC and SCC allocations as defined in Table 7.3.1A-1 form a contiguous allocation where TX–RX frequency separations of the component carriers are as defined in Table 5.7.4-1. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than the downlink SCC center frequency. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

	CA co	onfiguratio	on / CC c	ombinati	on / N <sub>RB_a</sub>	<sub>gg</sub> / Duple:	k mode			
	100RB	100RB+50RB 75R		B+75RB 100RE		+75RB	100RB+100RB		Duplox	
Uplink CA configuration	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	Duplex Mode	
CA_1C	N/A	N/A	75	54	N/A	N/A	100	30	FDD	
CA_7C	N/A	N/A	75	0	N/A	N/A	75	0	FDD	
CA_38C	N/A	N/A	75	75	N/A	N/A	100	100	TDD	
CA_40C	100	50	75	75	N/A	N/A	100	100	TDD	
CA_41C	100	50	75	75	100	75	100	100	TDD	
NOTE 2: The transmit	NOTE 1: The carrier centre frequency of SCC in the UL operating band is configured closer to the DL operating band. NOTE 2: The transmitted power over both PCC and SCC shall be set to P <sub>UMAX</sub> as defined in subclause 6.2.5A. NOTE 3: The UL resource blocks in both PCC and SCC shall be confined within the transmission bandwidth									

#### Table 7.3.1A-1: Intra-band contiguous CA uplink configuration for reference sensitivity

NOTE 4: The UL resource blocks in PCC shall be located as close as possible to the downlink operating band, while the UL resource blocks in SCC shall be located as far as possible from the downlink operating band.

configuration for the channel bandwidth (Table 5.6-1).

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the throughput of each downlink component carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with both downlink carriers active and parameters specified in Table 7.3.1-1 and Table 7.3.1A-3 with the power level in Table 7.3.1-1 increased by  $\Delta_{IBNC}$  given in Table 7.3.1A-3 for the SCC. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

Aggregated

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CA configuration	channel bandwidth (PCC+SCC)	W <sub>gap</sub> /[MHz]	UL PCC allocation	ΔR <sub>IBNC</sub> (dB)	Duplex mode	
	25RB+25RB	$30.0 < W_{gap} \le 55.0$	10 <sup>1</sup>	5.0		
	20KD+20KD	$0.0 < W_{gap} \le 30.0$	25 <sup>1</sup>	0.0		
	25RB+50RB	$25.0 < W_{gap} \le 50.0$	10 <sup>1</sup>	4.5		
	20KD+0UKD	$0.0 < W_{gap} \le 25.0$	25 <sup>1</sup>	0.0	FDD	
CA_25A-25A		15.0 < W <sub>gap</sub> ≤ 50.0	10 <sup>4</sup>	5.5	FUU	
	50RB+25RB	0.0 < W <sub>gap</sub> ≤ 15.0	32 <sup>1</sup>	0.0		
		$10.0 < W_{gap} \le 45.0$	10 <sup>4</sup>	5.0		
	50RB+50RB	0.0 < W <sub>gap</sub> ≤ 10.0	32 <sup>1</sup>	0.0		
CA_41A-41A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD	
NOTE 2: W <sub>gap</sub> is NOTE 3: The ca operat NOTE 4: <sup>4</sup> refer NOTE 5: For the only in NOTE 6: All cor NOTE 7: All app	ing band but confi s the sub-block gap arrier center freque ing band. s to the UL resourd e TDD intra-band r synchronized ope nbinations of chan blicable sub-block CC allocation is sa	ce blocks shall be located as c ned within the transmission. b between the two sub-blocks. ency of PCC in the UL operation ce blocks shall be located at R non-contiguous CA configuration eration between all component nel bandwidths defined in Tab gap sizes. me as Transmission bandwidth	ng band is conf B <sub>start</sub> =33. ons, the minim carriers. le 5.6A.1-3.	igured close um requirem	r to the DL nents apply	

# Table 7.3.1A-3: Intra-band non-contiguous CA uplink configuration for reference sensitivity with one uplink

## 7.3.1B Minimum requirements (QPSK) for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.3.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{UMAX}$  is the total transmitter power over the two transmit antenna connectors.

## 7.3.2 Void

## 7.4 Maximum input level

This is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

## 7.4.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1-1

Rx Parameter	Units	Channel bandwidth							
							20 MHz		
Power in Transmission Bandwidth Configuration	dBm	-25							
<ul> <li>NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.</li> <li>NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> </ul>									

 Table 7.4.1-1: Maximum input level

## 7.4.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the maximum input level is defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.4.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier.

The downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.4.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels over each component carrier as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1A-1.

For intra-band non-contiguous carrier aggregation with two downlink carriers each carrier shall meet the requirements specified in Table 7.4.1-1 while all downlink carriers are active.

The throughput shall be  $\geq$  95% of the maximum throughput of the specified reference measurement channel as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) over each carrier. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1A-3.

Rx Parameter	Units		CA Bandwidth Class							
		Α	В	С	D	E	F			
Power in largest Transmission Bandwidth Configuration CC	dBm			-25						
Power in each other CC	dBm			-25 + 10log(N <sup>RB,c</sup> /N <sub>RB,larg</sub> est BW)						
<ul> <li>NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.</li> <li>NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> </ul>										

Table 7.4.1A-1: Maximum input level for intra-band contiguous CA

### 7.4.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements in Clause 7.4.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.4A Void

7.4A.1 Void

## 7.5 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

### 7.5.1 Minimum requirements

The UE shall fulfil the minimum requirement specified in Table 7.5.1-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1-2 and Table 7.5.1-3 where the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

		Channel bandwidth								
Rx Parameter	Units	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
ACS	dB	33.0	33.0	33.0	33.0	30	27			

Rx Parameter	Units			Channel ba	andwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz					
Power in	dBm											
Transmission												
Bandwidth			REFSENS + 14 dB									
Configuration												
	dBm	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS					
PInterferer		+45.5dB	+45.5dB	+45.5dB	+45.5dB	+42.5dB	+39.5dB					
BWInterferer	MHz	1.4	3	5	5	5	5					
FInterferer (offset)	MHz	1.4+0.0025	3+0.0075	5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025					
. ,		/	/	/	/	/	/					
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-					
							0.0025					
NOTE 1: The tra	insmitter s	hall be set to 4d	B below PCMAX	⊥ at the minimum	uplink configura	ation specified i	n Table 7.3.1-					
2 with I	PCMAX_L as	defined in subcla	ause 6.2.5.									
NOTE 2: The int	erferer co	nsists of the Refe	erence measur	ement channel sp	pecified in Anne	x A.3.2 with one	e sided					
				ribed in Annex A								
C.3.1						•	-					

Rx Parameter	Units			Channel b	andwidth				
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in Transmission Bandwidth Configuration	dBm	-56.5	-56.5	-56.5	-56.5	-53.5	-50.5		
PInterferer	dBm		-25						
BWInterferer	MHz	1.4	3	5	5	5	5		
FInterferer (offset)	MHz	1.4+0.0025	3+0.0075	5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025		
		/	/	/	/	/	/		
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-		
							0.0025		
NOTE 1: The tra	insmitter s	hall be set to 24	dB below PCMA	x_L at the minimu	m uplink configu	ration specified	in Table		
		x_L as defined in				·			
NOTE 2: The int	erferer co	nsists of the Ref	erence measur	ement channel sp	pecified in Anne	x 3.2 with one s	ided dynamic		
OCNG	Pattern O	P.1 FDD/TDD a	s described in a	Annex A.5.1.1/A.	5.2.1 and set-up	according to A	nnex C.3.1.		

Table 7.5.1-3: Test parameters for Adjacent channel selectivity, Case 2

## 7.5.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band, the adjacent channel requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.5.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the adjacent channel requirements of subclause 7.5.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.5.1A-2 and Table 7.5.1A-3 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement specified in Table 7.5.1A-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.5.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active. The interferer powerP<sub>interferer</sub> for Case 1 in Table 7.5.1-2 shall be set to the maximum of the levels given by the two downlink carriers. For both Case 1 and Case 2 (Table 7.5.1-3), the wanted signal power level of each carrier shall be set in accordance with the ACS requirement (Clause 7.5.1) relative to the interferer power P<sub>interferer</sub>.

		CA Bandwidth Class					
Rx Parameter	Units	В	С	D	E	F	
ACS	dB		24				

Rx Parameter	Units	CA Bandwidth Class						
		В	С	D	E	F		
Pw in Transmission Bandwidth			REFSENS +					
Configuration, per CC			14 dB					
	dBm		Aggregated					
			power + 22.5					
PInterferer			dB					
BWInterferer	MHz		5					
F <sub>Interferer</sub> (offset)	MHz		2.5 + F <sub>offset</sub>					
			/					
			-2.5 - F <sub>offset</sub>					
NOTE 1: The transmitter shall be	set to 4dB	below P <sub>CM</sub>	AX_L,c Or PCMAX_L a	as defined in s	ubclause 6.2.5	iΑ.		
NOTE 2: The interferer consists of	of the Refer	ence meas	urement channe	I specified in A	nnex A.3.2 wi	th one sided		
dynamic OCNG Pattern	OP.1 FDD	/TDD as de	scribed in Annex	(A.5.1.1/A.5.2	2.1 and set-up	according to		
Annex C.3.1								
NOTE 3: The Finterferer (offset) is the	ne frequenc	y separatio	on of the center fr	equency of the	e carrier close	st to the		
interferer and the cente	r frequency	of the adja	cent channel inte	erferer and sha	all be further a	djusted to		
$F_{interferer} / 0.015 + 0.5 0.0$	015 + 0.007	5 MHz to b	e offset from the	sub-carrier rat	ster.			

Table 7.5.1A-2: Test parameters for Adjacent channel selectivity, Case 1

Table 7.5.1 A-3. Test parameters for	Adiacent channel selectivity. Case 2
	AUIAUEIII UIIAIIIIEI SEIEUIIVIIV. UASE Z

Rx Parameter	Units	ts CA Bandwidth Class					
		В	С	D	E	F	
Pw in Transmission Bandwidth Configuration, per CC	dBm		-47.5+10 log <sub>10</sub> (N <sub>RB,c</sub> / N <sub>RB agg</sub> )				
PInterferer	dBm			-25			
BWInterferer	MHz		5				
F <sub>Interferer</sub> (offset)	MHz		2.5+ F <sub>offset</sub>				
			/				
			-2.5- F <sub>offset</sub>				
NOTE 1: The transmitter shall be NOTE 2: The interferer consists of dynamic OCNG Pattern Annex C.3.1	of the Refe	erence measu	rement channel s	specified in Ar	nex 3.2 with or	e sided	
NOTE 3: The $F_{interferer}$ (offset) is the interferer and the center $\left[F_{interferer} / 0.015 + 0.5\right] 0.$	r frequenc	y of the adjace	ent channel inter	ferer and shal	l be further adju		

## 7.5.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.5.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

# 7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

## 7.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

#### 7.6.1.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1-1 and 7.6.1.1-2.

Rx parameter	Units	Channel bandwidth							
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Power in			REFSENS	+ channel band	width specific v	/alue below			
Transmission	dBm								
Bandwidth	ubiii	6	6	6	6	7	9		
Configuration									
BWInterferer	MHz	1.4	3	5	5	5	5		
Floffset, case 1	MHz	2.1+0.0125	4.5+0.0075	7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125		
Floffset, case 2	MHz	3.5+0.0075	7.5+0.0075	12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007		
					5	5	5		
NOTE 1: The tra	nsmitter	shall be set to	4dB below Pcr	MAX_L at the minii	mum uplink co	nfiguration spe	cified in		
Table 7	Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.								
NOTE 2: The inte	NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one								
sided d	ynamic C	OCNG Pattern	OP.1 FDD/TD	D as described i	in Annex A.5.1	.1/A.5.2.1 and	set-up		
accordi	ng to An	nex C.3.1							

E-UTRA	Parameter	Unit	Case 1	Case 2	Case 3	Case 4	Case 5
band	PInterferer	dBm	-56	-44			-38
	F <sub>Interferer</sub> (offset)	MHz	=-BW/2 - F <sub>loffset,case 1</sub> & =+BW/2 + F <sub>loffset,case 1</sub>	≤-BW/2 - F <sub>loffset,case 2</sub> & ≥+BW/2 + F <sub>loffset,case 2</sub>			-BW/2 - 11
$\begin{array}{c} 1,2,3,4,5,\\ 6,7,8,9,\\ 10,11,12,\\ 13,14,17,\\ 18,19,20,\\ 21,22,23,\\ 25,26,27,\\ 28,31,33,\\ 34,35,36,\\ 37,38,39,\\ 40,41,42,\\ 43,44 \end{array}$	FInterferer	MHz	(Note 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15	Void	Void	
30	F <sub>Interferer</sub>	MHz	(Note 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15			F <sub>DL_low</sub> -11
the	e first 15 MHz b	elow or a	above the UE receive I	rfering signal may not fa band Iid for two frequencies:	II inside the UE	E receive ban	d, but within
NOTE 2. 10	a. the carrier	requenc	y -BW/2 - F <sub>loffset, case 1</sub> a y +BW/2 + F <sub>loffset, case 1</sub>				
NOTE 3: Fin				terfering signal are inter	ferer center fra	equencies	

#### Table 7.6.1.1-2: In-band blocking

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.1.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the in-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier while both downlink carriers are active. For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A. For E-UTRA CA configurations including an operating

band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink in the band capable of UL operation.. The requirements for the component carrier configured in the operating band without uplink band are specified in Table 7.6.1.1-1 and Table 7.6.1.1A-0.

E-UTRA band	Parameter	Unit	Case 1	Case 2				
	PInterferer	dBm	-56	-44				
	F <sub>Interferer</sub> (offset)	MHz	=-BW/2 - F <sub>loffset,case 1</sub> & =+BW/2 + F <sub>loffset,case 1</sub>	≤-BW/2 – F <sub>loffset,case 2</sub> & ≥+BW/2 + F <sub>loffset,case 2</sub>				
29	FInterferer	MHz	(Note 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 15				
NOTE 1: For ce	rtain bands, the ur	nwanted mo	dulated interfering signal r	nay not fall inside the				
UE receive band, but within the first 15 MHz below or above the UE receive band NOTE 2: For each carrier frequency the requirement is valid for two frequencies: a. the carrier frequency -BW/2 - F <sub>loffset, case 1</sub> and								
NOTE 3: FInterfere	b. the carrier frequency +BW/2 + F <sub>loffset, case 1</sub> NOTE 3: F <sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies							

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the in-band blocking requirements of subclause 7.6.1.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.1.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.1.1A-1 and Tables 7.6.1.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active.

Rx Parameter	Units	CA Bandwidth Class						
		В	С	D	E	F		
Pw in Transmission		REFSENS + CA Bandwidth Class specific value below						
Bandwidth	dBm		12					
Configuration, per CC			12					
BWInterferer	MHz		5					
Floffset, case 1	MHz		7.5					
Floffset, case 2	MHz		12.5					
NOTE 1: The transmit	ter shall b	be set to 4dB bel	OW PCMAX_L,c OF P	CMAX_L as define	ed in subclause 6.2	2.5A		
NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided								
dynamic OC	dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to							
Annex C.3.1								

Table 7.6.1.1A-1: In band blocking parameters

CA	configuration	Parameter	Unit	Case 1	Case 2		
		PInterferer	dBm	-56	-44		
		F <sub>Interferer</sub> (offset)	MHz	=-F <sub>offset</sub> - F <sub>loffset,case 1</sub> & =+F <sub>offset</sub> + F <sub>loffset,case 1</sub>	≤-F <sub>offset</sub> - F <sub>loffset,case 2</sub> & ≥+F <sub>offset</sub> + F <sub>loffset,case 2</sub>		
CA_1C, CA_7C, CA_38C, CA_40C, CA_41CFinterferer (Range)MHz(Note 2)FDL_low - 15 to FDL_high + 15							
<ul> <li>NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band</li> <li>NOTE 2: For each carrier frequency the requirement is valid for two frequencies:</li> </ul>							
	a. the carrier freque b. the carrier freque			d			
NOTE 3: F <sub>offset</sub> is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.							
NOTE 4:	NOTE 4: The F <sub>interferer</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer tested and shall be further adjusted to $ F_{interferer}/0.015 + 0.5 0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.						

Table 7.6.1.1A-2: In-band blocking

## 7.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1 and subclause 7.6.1 shall be applied.

### 7.6.2.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1-2.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$  exceptions are allowed for spurious

response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \left[ (N_{RB} + 2 \cdot L_{CRBs})/8 \right])$  exceptions are allowed for spurious

response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and  $L_{CRBs}$  is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Rx Parameter	Units	Channel bandwidth						
		1.4	3 MHz	5 MHz	10	15	20	
		MHz			MHz	MHz	MHz	
Power in	REFS	REFSENS + channel bandwidth specific value below						
Transmission	dBm							
Bandwidth	ubiii	6	6	6	6	7	9	
Configuration								
NOTE 1: The transmit	e set to 40	B below I	Рсмах_∟ at	the minim	num uplink	ζ.		
configuration	in Table 7	7.3.1-2 wit	h PCMAX_L	as define	d in subcla	ause		
6.2.5.								
NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sidec								
dynamic OC	NG Patterr	dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5					A.5.2.	

Table 7.6.2.1-1: Out-of-band blocking parameters

E-UTRA band	Parameter	Units		Free	quency		
			Range 1	Range 2	Range 3	Range 4	
	PInterferer	dBm	-44	-30	-15	-15	
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,			F <sub>DL_low</sub> -15 to F <sub>DL_low</sub> -60	F <sub>DL_low</sub> -60 to F <sub>DL_low</sub> -85	F <sub>DL_low</sub> -85 to 1 MHz	-	
12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 (NOTE 2), 43 (NOTE 2), 44	F <sub>Interferer</sub> (CW)	MHz	F <sub>DL_high</sub> +15 to F <sub>DL_high</sub> + 60	F <sub>DL_high</sub> +60 to F <sub>DL_high</sub> +85	F <sub>DL_high</sub> +85 to +12750 MHz	-	
2, 5, 12, 17	FInterferer	MHz	-	-	-	F <sub>UL_low</sub> - F <sub>UL_high</sub>	
NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.							
			er (P <sub>Interferer</sub> ) for Rar	nge 3 shall be mod	lified to -20 dBm for	F <sub>Interferer</sub> > 2800	
MHz a	and F <sub>Interferer</sub> < 4	400 MHz.					

#### 7.6.2.1A Minimum requirements for CA

For inter-band carrier aggregation with the uplink assigned to one E-UTRA band, the out-of-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput in the downlink measured shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1A-0. The UE shall meet these requirements for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the out-of-band blocking requirements of subclause 7.6.2.1A do not apply.

Table 7.6.2.1A-0: out-of-band blocking	for inter-band carrier a	aggregation with one active uplink

Paramete	er Unit	Range 1	Range 2	Range 3					
Pw	dBm	Table 7.6.	carriers						
Pinterferer	dBm	-44 + ΔR <sub>IB,c</sub>	-30 + ∆R <sub>IB,c</sub>	-15 + ∆R <sub>IB,c</sub>					
Finterferer	MHz	$-60 < f - F_{DL_{Low(1)}} < -15$	$-85 < f - F_{DL_{Low(1)}} \le -60$	$1 \le f \le F_{DL\_Low(1)} - 85$					
(CW)		or	or	or					
		$-60 < f - F_{DL_{Low(2)}} < -15$	$-85 < f - F_{DL_{Low(2)}} \le -60$	$F_{DL_{High(1)}} + 85 \le f$					
		or	or	$\leq F_{DL_{Low(2)}} - 85$					
		$15 < f - F_{DL_{High(1)}} < 60$	$60 \le f - F_{DL_{High(1)}} < 85$	or					
		or	or	$F_{DL_High(2)} + 85 \le f$					
		$15 < f - F_{DL_{High(2)}} < 60$	$60 \leq f - F_{DL_{High(2)}} < 85$	≤ 12750					
NOTE 1:		nd F <sub>DL_High(1)</sub> denote the respec							
	operating b	and, F <sub>DL_Low(2)</sub> and F <sub>DL_High(2)</sub> th	ne respective lower and up	per frequency limits of the					
	upper oper	ating band.							
NOTE 2:	For F <sub>DL_Low</sub>	$_{(2)} - F_{DL_High(1)} < 145 \text{ MHz and}$	FInterferer in FDL_High(1) < f < F	<sub>DL_Low(2)</sub> , F <sub>Interferer</sub> can be					
	in both Rar	nge 1 and Range 2. Then the lo	ower of the PInterferer applies	5.					
NOTE 3:	For $F_{DL \ Low(1)} - 15 \ MHz \le f \le F_{DL \ High(1)} + 15 \ MHz \ and \ F_{DL \ Low(2)} - 15 \ MHz \le f \le F_{DL \ High(2)} + 15$								
	MHz the appropriate adjacent channel selectivity and in-band blocking in the respective								
	subclauses	7.5.1A and 7.6.1.1A shall be	applied.						
NOTE 4:	$\Delta R_{IB,c}$ acco	rding to Table 7.3.1-1A applies	s when serving cell <i>c</i> is me	asured.					

For Table 7.6.2.1A-0 in frequency ranges 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per downlink are allowed for spurious response frequencies when measured using a step size of 1 MHz. For these exceptions the requirements in clause 7.7.1A apply.

For intra-band contiguous carrier aggreagations the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.2.1A-1 with the uplink configuration set according to Table 7.3.1A-1

for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.2.1A-1 and Tables 7.6.2.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For Table 7.6.2.1A-2 in frequency range 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

Rx Parameter	Units	CA Bandwidth Class					
		В	С	D	E	F	
Pw in Transmission Bandwidth Configuration, per CC	dBm	Bm REFSENS + CA Bandwidth Class spo Bm below					
	I T		9				
NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A. NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.						ern OP.1	

Table 7.6.2.1A-2: Out of band blocking

CA configuration	Parameter	Units	Frequency		
			Range 1	Range 2	Range 3
	PInterferer	dBm	-44	-30	-15
	E.		F <sub>DL_low</sub> -15 to F <sub>DL_low</sub> -60	F <sub>DL_low</sub> -60 to F <sub>DL_low</sub> -85	F <sub>DL_low</sub> -85 to 1 MHz
CA_1C, <u>CA_3C</u> , CA_7C , CA_38C, CA_40C, CA_41C	F <sub>Interferer</sub> (CW)	MHz	$F_{DL_{high}} + 15$ to $F_{DL_{high}} + 60$	F <sub>DL_high</sub> +60 to F <sub>DL_high</sub> +85	F <sub>DL_high</sub> +85 to +12750 MHz

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the out-of-band blocking requirements are defined with the uplink configuration in accordance with table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.2.1 for each component carrier while both downlink carriers are active.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

## 7.6.3 Narrow band blocking

This requirement is measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

#### 7.6.3.1 Minimum requirements

The relative throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1-1

Parameter	Unit	Channel Bandwidth							
Farameter		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Р	dBm	P <sub>REFSENS</sub> + channel-bandwidth specific value below							
Pw		22	18	16	13	14	16		
P <sub>uw</sub> (CW)	dBm	-55	-55	-55	-55	-55	-55		
$F_{uw}$ (offset for $\Delta f = 15 \text{ kHz}$ )	MHz	0.9075	1.7025	2.7075	5.2125	7.7025	10.2075		
$F_{uw}$ (offset for $\Delta f = 7.5 \text{ kHz}$ )	MHz								
NOTE 1: The transmitter shall be set a 4 dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.									
NOTE 2: Referer OCNG	nce measurem Pattern OP.1 F						amic		

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{UW}$  power defined in Table 7.6.3.1-1 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.3.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the narrow-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the narrow-band blocking requirements of subclause 7.6.3.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.3.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active.

Deremeter	Unit	CA Bandwidth Class						
Parameter	Unit	В	С	D	E	F		
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + CA Bandwidth Class specific value below						
P <sub>uw</sub> (CW)	dBm		-55					
$F_{uw}$ (offset for $\Delta f = 15 \text{ kHz}$ )	MHz		- F <sub>offset</sub> - 0.2 / + F <sub>offset</sub> + 0.2					
$F_{uw}$ (offset for $\Delta f = 7.5$ kHz)	MHz							
NOTE 2: Reference measureme FDD/TDD as described NOTE 3: The F <sub>uw</sub> (offset) is the f	<ol> <li>The transmitter shall be set to 4dB below P<sub>CMAX_L,c</sub> or P<sub>CMAX_L</sub> as defined in subclause 6.2.5A.</li> <li>Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> <li>The F<sub>uw</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interfererand shall be further adjusted to [F<sub>interferer</sub>/0.015+0.5]0.015+0.0075 MHz</li> </ol>							
to be offset from the su NOTE 4: The requirement is app		mbinations	whose component	carriers' BW	/>5 MHz.			

#### Table 7.6.3.1A-1: Narrow-band blocking

## 7.6A Void

<Reserved for future use>

# 7.6B Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.6 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.7 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in subclause 7.6.2 is not met.

## 7.7.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2.

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 2				
Power in		REFSENS + channel bandwidth specific value below					
Transmission Bandwidth Configuration	dBm	6	6 6 6 6 7 9				
NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2.							
N OTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.							

Table 7.7.1-1: Spurious response parameters
---------------------------------------------

Parameter	Unit	Level
P <sub>Interferer</sub> (CW)	dBm	-44
F <sub>Interferer</sub>	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{interferer}$  power defined in Table 7.7.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.7.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the spurious response requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput measured in each downlink with  $F_{interferer}$  in Table 7.6.2.1A-0 at spurious response frequencies shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. The UE shall meet these requirements for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the spurious response requirements of subclause 7.7.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.7.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the spurious response requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in clause 7.7.1 for each component carrier while both downlink carriers are active.

Rx Parameter	Units	CA Bandwidth Class					
	В	С	D	E	F		
Pw in Transmission Bandwidth	ridth dBm REFSENS + CA Bandwidth Class specific value below					e below	
Configuration, per CC	ifiguration, per CC 9						
NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.							
NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern							
OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.							

Table 7.7.1A-1:	Spurious	response	parameters
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Parameter	Unit	Level
P <sub>Interferer</sub> (CW)	dBm	-44
F <sub>Interferer</sub>	MHz	Spurious response frequencies

## 7.7.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

# 7.8 Intermodulation characteristics

Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

## 7.8.1 Wide band intermodulation

The wide band intermodulation requirement is defined following the same principles using modulated E-UTRA carrier and CW signal as interferer.

## 7.8.1.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1.1 for the specified wanted signal mean power in the presence of two interfering signals

Rx Parameter	· Units	Channel bandwidth						
		1.4 MHz 3 MHz			5 MHz	10 MHz	15 MHz	20 MHz
Power in		RE	EFSEN	S + char	nel bandwi	dth specific	value below	
Transmission Bandwidth Configuration	dBm	12		8	6	6	7	9
PInterferer 1 (CW)	dBm		-46					
P <sub>Interferer 2</sub> (Modulated)	dBm		-46					
BW Interferer 2		1.4	1.4 3 5					
F <sub>Interferer 1</sub> (Offset)	MHz	-BW/2 -2.1 -BW/2 -4.5 -BW/2 - 7.5 / / / / / / / / / / / / / / / / / / /						
F <sub>Interferer 2</sub> (Offset)	MHz	2*FInterferer 1						
<ul> <li>NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.</li> <li>NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> </ul>								
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E- UTRA signal as described in Annex D for channel bandwidth ≥5MHz								

Table 7.8.1.1-1: Wide band intermodulation

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{interferer1}$  and  $P_{interferer2}$  powers defined in Table 7.8.1.1-1 are increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.8.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the wide band intermodulation requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA

CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the wideband intermodulation requirements of subclause 7.8.1A do not apply.

For intra-band contiguous carrier aggegation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.8.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggreagation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1A-1

Rx parameter	Units	CA Bandwidth Class						
		В	С	D	E	F		
Pw in		RI	EFSENS + CA B	andwidth Class	specific value be	elow		
Transmission	alDura							
Bandwidth Configuration, pe	dBm		12					
CC	51							
P <sub>Interferer 1</sub> (CW)	dBm			-46				
P <sub>Interferer 2</sub> (Modulated)	dBm			-46				
BW Interferer 2	MHz		5					
FInterferer 1	MHz		-F <sub>offset</sub> -7.5					
(Offset)			_ /					
			+ F <sub>offset</sub> +7.5					
F <sub>Interferer 2</sub> (Offset)	MHz	2*F <sub>Interferer 1</sub>						
NOTE 1: The tr								
		rement channel is specified in Annex A.3.2 with one sided dynamic OCNG //TDD as described in Annex A.5.1.1/A.5.2.1.						
					ah ann al an a aifi a	d in Annaly		
		erferer consists of the Reference measurement channel specified in Annex						
		ed dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex th set-up according to Annex C.3.1.						
		odulated signal is 5MHz E-UTRA signal as described in Annex D for channel						
	vidth ≥5MHz.							
		et) is the freque	ncy separation of	the center freq	uency of the car	rier closest to		
			ency of the CW i					
			of the carrier clo					
of the	modulated in	nterferer.				-		

Table 7.8.1A-1: Wide band intermodulation

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while both downlink carriers are active. The wide band intermodulation requirements shall be supported for out-of-gap test only.

## 7.8.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.8.2 Void

## 7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

## 7.9.1 Minimum requirements

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1-1

Table 7.9.1-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	Note			
30MHz ≤ f < 1GHz	100 kHz	-57 dBm				
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm				
$ \begin{array}{c c} 12.75 \ \text{GHz} \leq \text{f} \leq 5^{\text{th}} \ \text{harmonic} & 1 \ \text{MHz} & -47 \ \text{dBm} & 1 \\ \hline \text{of the upper frequency edge} \\ \text{of the DL operating band in} \\ \hline \text{GHz} & & \\ \end{array} $						
<ul> <li>NOTE 1: Applies only for Band 22, Band 42 and Band 43</li> <li>NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH_RA/RB as defined in Annex C.3.1.</li> </ul>						

## 7.9.1A Minimum requirements

For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1A-1.

Frequency band	Measurement bandwidth	Maximum level	Note
$30MHz \le f < 1GHz$	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
by PDCCH_RA/RB	as defined in Anne	ex C.3.1.	e element groups with power level given or carrier aggregation but is not

## 7.10 Receiver image

## 7.10.1 Void

## 7.10.1A Minimum requirements for CA

Receiver image rejection is a measure of a receiver's ability to receive the E-UTRA signal on one component carrier while it is also configured to receive an adjacent aggregated carrier. Receiver image rejection ratio is the ratio of the wanted received power on a sub-carrier being measured to the unwanted image power received on the same sub-carrier when both sub-carriers are received with equal power at the UE antenna connector.

For intra-band contiguous carrier aggregation the UE shall fulfil the minimum requirement specified in Table 7.10.1A-1 for all values of aggregated input signal up to -22 dBm.

			CA ba	ndwidth	class		
Rx parameter	Units	Α	В	С	D	E	F
Receiver image rejection	dB			25			

## Table 7.10.1A-1: Receiver image rejection

# 8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

Note: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

## 8.1 General

### 8.1.1 Dual-antenna receiver capability

The performance requirements are based on UE(s) that utilize a dual-antenna receiver.

For all test cases, the SNR is defined as

$$SNR = \frac{\hat{E}_s^{(1)} + \hat{E}_s^{(2)}}{N_{oc}^{(1)} + N_{oc}^{(2)}}$$

where the superscript indicates the receiver antenna connector. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

For enhanced performance requirements type A, the SINR is defined as

$$SINR = \frac{\hat{E}_{s}^{(1)} + \hat{E}_{s}^{(2)}}{N_{oc}^{(1)'} + N_{oc}^{(2)'}}$$

where the superscript indicates the receiver antenna connector. The above SINR definition assumes that the REs are not precoded. The SINR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SINR requirement applies for the UE categories given for each test.

#### Table 8.1.1-1: Void

- 8.1.1.1 Simultaneous unicast and MBMS operations
- 8.1.1.2 Dual-antenna receiver capability in idle mode
- 8.1.2 Applicability of requirements

#### 8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

#### 8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1.

CA Capability	CA Capability Description
CA2_C	Intra-band contiguous CA
CA2_A2	Inter-band CA
C2A_N2	Intra-band non-contiguous CA
COR CA COR CA	2_C corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-1 for 2 DL CCs. 2_A2 corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-2 for 2 DL CCs. 2_N2 corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-3 for 2 DL CCs.

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

# Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

CA Capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA
CA2_C	20+20MHz	20+20MHz
CA2_A2	10+10MHz, 10+15MHz,	NA
	10+20MHz, 15+20MHz,	
	20+20MHz	
CA2_N2	10+10MHz	20+20MHz
Note 1: This	table is only for information a	nd applicability and test rules
of C	A performance requirements a	are specified in 8.1.2.3 and
9.1.	1.2.	

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers, unless otherwise stated.

# 8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.1.1.1, 8.2.1.4.3	Any one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz
CA tests with 2CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability	10+10 MHz, 20+20 MHz
CA tests with 2CCs in Clause 8.2.1.3.1A, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.1.7.1	CA2_C	Supported FDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.2.1.1, 8.2.2.4.3	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1A, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in 8.2.2.7.1	CA2_C	Supported TDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.1.8.1	CA2_N2	CA_3A-3A defined in Table 5.6A.1-3	10+10 MHz
Note 2: Number		les are specified in this table, u andwidth combinations to be te	

## 8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

# 8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

## 8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

#### Table 8.2.1-1: Common Test Parameters (FDD)

### 8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

#### 8.2.1.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Parame	ter	Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
Develielenever	ink nower $\rho_A$ dB		0	0	0	0	0
Downlink power $\rho_B$		dB	0 (Note 1)				
	σ	dB	0	0	0	0	0
$N_{_{oc}}$ at anter	na port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for unused PRBs			OCNG (Note 2)				
Modulation			QPSK	16QAM	64QAM	16QAM	QPSK
PDSCH transmis	sion mode		1	1	1	1	1
Note 1: $P_B = 0$							
	e data transm	ource blocks are hitted over the O					
Note 3: Void. Note 4: Void.							

#### Table 8.2.1.1.1-1: Test Parameters

		Propa- Correlation		Reference	value			
Test	Band-	Reference	OCNG	gation	matrix and	Fraction of		UE
num.	width	channel	pattern	condi-	antenna	maximum	SNR	cate
num.	Width	enamer	pattern	tion	config.	throughput	(dB)	gory
					_	(%)		
1	10 MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥1
2	10 MHz	R.2 FDD	OP.1 FDD	ETU70	1x2 Low	70	-0.4	≥1
3	10 MHz	R.2 FDD	OP.1 FDD	ETU300	1x2 Low	70	0.0	≥1
4	10 MHz	R.2 FDD	OP.1 FDD	HST	1x2	70	-2.4	≥1
5	1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	0.0	≥1
6	10 MHz	R.3 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	≥2
0	5 MHz	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	≥2
1	5 MHz	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2
0	5 MHz	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	1
9	3 MHz	R.5 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥1
10	5 MHz	R.6 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.4	≥2
10	5 MHz	R.6-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.5	1
11	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2
11	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1
12	10 MHz	R.7 FDD	OP.1 FDD	ETU70	1x2 Low	70	19.0	≥2
12	10 MHz	R.7-1 FDD	OP.1 FDD	ETU70	1x2 Low	70	18.1	1
13	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 High	70	19.1	≥2
13	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 High	70	17.8	1
14	15 MHz	R.8 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2
14	15 MHz	R.8-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.8	1
	20 MHz	R.9 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥3
15	20 MHz	R.9-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.3	2
	20 MHz	R.9-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1
16	3 MHz	R.0 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
17	10 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
18	20 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
19	10 MHz	R.41 FDD	OP.1 FDD	EVA5	1x2 Low	70	-5.4	≥1
Note 1	: Void.							
Note 2								
Note 3	: Void.							

Table 8.2.1.1.1-2: Minimum performance (FRC)
----------------------------------------------

Parameter		Unit	Test 1-2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power - allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)

	σ	dB	0				
$N_{\scriptscriptstyle oc}$ a	t antenna port	dBm/15kHz	-98				
Symbols	for unused PRBs		OCNG (Note 2)				
M	odulation		QPSK				
PDSCH tr	ansmission mode		1				
Note 1: $P_B$	= 0 .						
with	Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.						
	PUCCH format 1b with channel selection is used to feedback ACK/NACK.						
Note 4: The	same PDSCH transmis	sion mode is appli	ed to each component carrier.				

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA

				Propa-	Correlation	Reference		
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.2 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.1	≥3 (Note 2)
2	2x20 MHz	R.42 FDD	OP.1 FDD (Note 1)	EVA5	1x2 Low	70	-1.3	≥5
Note 1	Note 1: The OCNG pattern applies for each CC.							
Note 2	Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.							
Note 3	: The applic	ability of requiren	nents for diffe	erent CA co	onfigurations a	nd bandwidth c	ombination se	ts is defined
	in 8.1.2.3.							

8.2.1.1.2 Void

#### 8.2.1.1.3 Void

#### 8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

	Parameter		Unit	Test 1		
		$ ho_{\scriptscriptstyle A}$	dB	0		
	nk power $\rho_{\scriptscriptstyle B}$		dB	0 (Note 1)		
		σ	dB	0		
$N_{a}$	$_{c}$ at antenna	port	dBm/15kHz -98			
Symbols for MBSFN portion of MBSFN subframes (Note 2)				OCNG (Note 3)		
PDSCH transmission mode				1		
Note 1: $P_B = 0$ Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the first slot						
Note 3:	first slot. The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes, QPSK modulated MBSFN data is used instead.					

 Table 8.2.1.1.4-1: Test Parameters for Testing 1 PRB allocation

Table 8.2.1.1.4-2: Minimum	performance 1PRB (F	RC)
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Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.29 FDD	OP.3 FDD	ETU70	1x2 Low	30	2.0	≥1

### 8.2.1.2 Transmit diversity performance

#### 8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.1.2.1-1: Test Parameters for Transmit divers	ty Performance (FRC)
--------------------------------------------------------	----------------------

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		2
Note 1: $P_B = 1$ .			

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	Category
1	10 MHz	R.11 FDD	OP.1 FDD	EVA5	2x2 Medium	70	6.8	≥2
	5 MHz	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	1
2	10 MHz	R.10 FDD	OP.1 FDD	HST	2x2	70	-2.3	≥1

Table 8.2.1.2.1-2: Minimum performance Transmit Diversity (FRC)

#### 8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.1.2.2-1: Test Parameters for Transmit diversity Performance (FRC)
-----------------------------------------------------------------------------

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		2
Note 1: $P_B = 1$ .			

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	1.4 MHz	R.12 FDD	OP.1 FDD	EPA5	4x2 Medium	70	0.6	≥1
2	10 MHz	R.13 FDD	OP.1 FDD	ETU70	4x2 Low	70	-0.9	≥1

# 8.2.1.2.3 Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Deremeter		Unit	Cell 1	Cell 2
Parameter			1	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	N/A
	$N_{oc1}$	dBm/15kHz	-102 (Note 2)	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A
	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.2.1.2.3-2	6
BW <sub>Channel</sub>		MHz	10	10
Subframe Configuration			Non-MBSFN	Non-MBSFN
Time Offset between	Cells	μs	2.5 (synchror	nous cells)
Cell Id			0	1
ABS pattern (Note	5)		N/A	11000100 11000000 11000000 11000000 11000000
RLM/RRM Measurement Pattern (Note 6)	Subframe		1000000 1000000 1000000 1000000 1000000	N/A
	C <sub>CSI,0</sub>		11000100 11000000 11000000 11000000 11000000	N/A
CSI Subframe Sets (Note7)	C <sub>CSI,1</sub>		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDM	symbols		2	2
PDSCH transmission	mode		2	N/A
Cyclic prefix			Normal	Normal
overlapping with th Note 3: This noise is applie ABS. Note 4: This noise is applie Note 5: ABS pattern as de Note 6: Time-domain meas Note 7: As configured accor measurements def	e aggressor A ed in OFDM sy ed in all OFDM fined in [9]. surement reso ording to the ti ined in [7].	ymbols #1, #2, #3, #5, #6, a ABS. ymbols #0, #4, #7, #11 of a A symbols of a subframe ov purce restriction pattern for me-domain measurement s the aggressor cell. The n	a subframe overlapping verlapping with aggress PCell measurements as resource restriction patt	with the aggressor or non-ABS s defined in [7] ern for CSI
is the same. Note 9: SIB-1 will not be tr	-			

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Test Number	Reference Channel		OCNG         Propagation         Correlation           Pattern         Conditions         Matrix and           (Note 1)         Antenna		Matrix and	Reference Value		UE Category	
		Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11-4 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA5	EVA 5	2x2 Medium	70	3.4	≥2
Note 1:					Cell2 are	statistically indep	bendent.		
Note 2:	SNR correspo	nds to $\widehat{E}$	$s/N_{oc2}$	of cell 1.					
<ul> <li>Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.</li> <li>Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated</li> <li>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.</li> </ul>									
Note 5:	The maximum	Through	put is cal	culated fi	rom the tota	al Payload in 9 s	ubframes, avera	aged ove	r 40ms.

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

# 8.2.1.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.2.3A-2, with the addition of parameters in Table 8.2.1.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Parameter		Unit	Cell 1	Cell 2	Cell 3			
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3			
Downlink power allocation	$\rho_{B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)			
anocation	σ	dB	0	N/A	N/A			
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A			
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 3)	N/A	N/A			
	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 4)	N/A	N/A			
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table8.2.1.2.3A- 2	12	10			
BW <sub>Channel</sub>		MHz	10	10	10			
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN			
Time Offset betwee	n Cells	μs	N/A	3	-1			
Frequency shift betwe	en Cells	Hz	N/A	300	-100			
Cell Id			0	126	1			
ABS pattern (Not	e 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000			
RLM/RRM Measur Subframe Pattern (f			10000000 10000000 10000000 10000000 1000000	N/A	N/A			
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A			
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A			
Number of control ( symbols	OFDM		2	Note 8	Note 8			
PDSCH transmissio	n mode		2	Note 9	Note 9			
Cyclic prefix			Normal	Normal	Normal			
<ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 5: ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> <li>Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.</li> <li>Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying</li> </ul>								
OCNG patte Note 10: The number	of the CRS	ed in Annex A.5. S ports in Cell 1,						

 Table 8.2.1.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Test Number	Reference Channel	OCNG Pattern			Propaga	ation Cor (Note1)	ditions	Correlation Matrix and	Reference	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11-4 FDD Note 4	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.4	≥2
Note 1: Note 2:	The correlation	n matrix a	and anten	na config	guration ap			y independent. 2 and Cell 3.			<u> </u>
Note 3:	SNR correspo	nds to $E$	$_{s}/N_{oc2}$	of cell 1							
Note 4:		the servir	ng cell sul	oframe v	when the s	ubframe i	s overlap	and its associate ped with the ABS			l and

Table 8.2.1.2.3A-2: Minimum Performance Transmit Diversity (FRC)

Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

# 8.2.1.2.4 Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.1.2.4-2, with the addition of parameters in Table 8.2.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.1.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Parameter		Unit	Cell 1	Cell 2	Cell 3				
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3				
	σ	dB	0	0	0				
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1				
$N_{oc}$ at antenna po	dBm/15kHz	-98	N/A	N/A					
DIP (Note 2)	dB	N/A	-2.23	-8.06					
BW <sub>Channel</sub>	MHz	10	10	10					
Cyclic Prefix		Normal	Normal	Normal					
Cell Id			0	1	2				
Number of control OFDM	symbols		2	2	2				
PDSCH transmission			2	N/A	N/A				
Interference mod	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2				
Probability of occurrence of	Rank 1	%	N/A	80	80				
transmission rank in interfering cells	Rank 2	%	N/A	20	20				
Reporting interva	l	ms	5	N/A	N/A				
Reporting mode			PUCCH 1-0	N/A	N/A				
Physical channel for CQI	reporting		PUSCH(Note 5)	N/A	N/A				
cqi-pmi-Configuration	Index		2	N/A	N/A				
Note 1: $P_{\rm B} = 1$			1	· · · ·					
Note 2: The respective rec	eived power s	spectral density of	of each interfering	cell relative to N	ູ໌ is defined by				
its associated DIP				t.	-				
Note 3: Cell 1 is the servin									
				d Cell 3 transmiss	sion is delayed				
	Note 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms and Cell 3 transmission is delayed with respect to Cell 1 by 0.67 ms.								
Note 5: To avoid collisions instead of PUCCH	between CQI	reports and HA format 0 shall b	e transmitted in do	ownlink SF#1 and	#6 to allow				
periodic CQI to mu	nuplex with the	E DARQ-AUN OF	і ғозоп ін uplink	Sublighte SF#5 a	iiiu #0.				

# Table 8.2.1.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

# Table 8.2.1.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern			Correlation Matrix and	Reference	Value	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.46 FDD	OP. 1 FD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.1	≥1
Note 1:								e statistically inc	dependent.		
Note 2: SINR corresponds to $\hat{E}_s / N_{oc}$ of Cell 1 as defined in clause 8.1.1.											
Note 3:	Correlation ma	trix and	anten	na conf	iguratic	on para	meters	apply for each o	f Cell 1, Cell 2 a	nd Cell 3.	

#### 8.2.1.3 Open-loop spatial multiplexing performance

#### 8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Parameter		Unit	Test 1-2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
PDSCH transmissio	on mode		3
Note 1: $P_B = 1$ .			
Note 2: Void Note 3: Void			

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

#### Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC)

				Propa-	Correlation	Reference	value	
Test num	Bandwidth	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE category
1	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.0	≥2
2	10 MHz	R.35 FDD	OP.1 FDD	EVA200	2x2 Low	70	20.2	≥2
3	10 MHz	R.35-4 FDD	OP.1 FDD	ETU300	2x2 Low	70	19.7	≥2
Note 1: Note 2:	Void. Test 1 may no	ot be executed	d for UE-s for	which Test 1	or 2 in Table 8.2.	1.3.1-4 is applic	able.	

#### Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

	Parameter		Unit	Test 1-3				
Develie	le manuar	$ ho_{\scriptscriptstyle A}$	dB	-3				
	ik power ation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)				
		σ	dB	0				
Noo	at antenna	port	dBm/15kHz	-98				
PDSCH	transmissio	on mode		3				
Note 1:	$P_B = 1$ .							
Note 2:	Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.							
Note 3:	The same PDSCH transmission mode is applied to each component carrier.							

			Propa-	Correlation	Reference value		
Te: nur	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate- gory

1	2x10 MHz	R.11 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.7	≥3			
2	2x20 MHz	R.30 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.2	≥5			
Note 1:	The OCNO	G pattern applies f	or each CC.								
Note 2:	Void.										
Note 3:	Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined										
	in 8.1.2.3.										

#### 8.2.1.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.2.1.3.1A-3.

Parameter			Unit	Test 1-7	
Daurikalanaan		$ ho_{\scriptscriptstyle A}$	dB	-3	
Downlink pow allocation	er	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	
		σ	dB	0	
$N_{\scriptscriptstyle oc}$ at ant	enna	port	dBm/15kHz	-98	
PDSCH transr	nissio	n mode		3	
Note 1: $P_B = 1$ .					
	Note 2:For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.Note 3:For CA test cases, the same PDSCH transmission mode				
is applied to each component carrier.					

	Bandwi dth	Reference channel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Reference value	
Test num						Fraction of maximum Throughput (%)	SNR (dB)
1	2x20 MHz	R.30 FDD	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.2
2	15MHz +	R.35-2 FDD for 15MHz CC	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.1
2	10MHz	R.35-3 FDD for 10MHz CC	OP.1 FDD (Note 1)	EVAS	ZXZ LOW	70	15.1
3	20MHz +	R.30 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.5
3	10MHz	R.11 FDD for 10MHz CC	OP.1 FDD (Note 1)			70	13.5
4	20MHz +	R.30 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.5
4	15MHz	R.30-1 FDD for 15MHz CC	OP.1 FDD (Note 1)			70	13.5
5	2x20 MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.8
6	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.9
0	10MHz	R.35-3 FDD for 10MHz CC	OP.1 FDD (Note 1)	EVAJ	ZXZ LOW	70	15.9
7	20MHz + 15MHz	R.35-1 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.9
1		R.35-2 FDD for 15MHz CC	OP.1 FDD (Note 1)			70	15.9
Note 1: Note 2: Note 3:	te 2: For Test 2, 3, 4, 6, 7 the Fraction of maximum Throughput applies to each CC.						

Table 8.2.1.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

#### Table 8.2.1.3.1A-3: Test points for soft buffer management tests for CA

	Bandwidth combination with maximum aggregated bandwidth (Note 1)					
UE category	2x20MHz 15MHz+10MHz		20MHz+10MHz	20MHz+15MHz		
3	1	2	3	4		
4 5		N/A	6	7		
Note 1: Maximum	Note 1: Maximum over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1- 1and Table 5.6A.1-2.					
1and Table						

#### 8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.1.3.2-1: Test Parameters for La	arge Delay CDD (FRC)

Parameter		Unit	Test 1		
Deumlink neuron	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98		
PDSCH transmission	on mode		3		
Note 1: $P_B = 1$					

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 FDD	OP.1 FDD	EVA70	4x2 Low	70	14.3	≥2

Table 8.2.1.3.2-2: Minimum performance Large Delay CDD (FRC)

# 8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Parameter		Unit	Cell 1	Cell 2				
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3				
Downlink power allocation	$\rho_{B}$	dB	-3 (Note 1)	-3				
	σ	dB	0	N/A				
	N <sub>oc1</sub>	dBm/15kHz	-102 (Note 2)	N/A				
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 3)	N/A				
	N <sub>oc3</sub>	dBm/15kHz	-94.8 (Note 4)	N/A				
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.2.1.3.3-2	6				
BW <sub>Channel</sub>		MHz	10	10				
Subframe Configura	ation		Non-MBSFN	Non-MBSFN				
Cell Id			0	1				
Time Offset between	Cells	μs	2.5 (synchror	nous cells)				
ABS pattern (Note	95)		N/A	11000100, 11000000, 11000000, 11000000, 11000000,				
RLM/RRM Measurement Pattern(Note 6)			1000000 1000000 1000000 1000000 1000000 1000000	N/A				
CSI Subframe Sets (Note	C <sub>CSI,0</sub>		11000100 11000000 11000000 11000000 11000000	N/A				
7)	C <sub>CSI,1</sub>		00111011 00111111 00111111 00111111 00111111	N/A				
Number of control OFDN	I symbols		2	2				
PDSCH transmission			3	N/A				
Cyclic prefix			Normal	Normal				
overlapping with tNote 3:This noise is appl aggressor ABS.Note 4:This noise is applNote 5:ABS pattern as do Note 6:Note 6:Time-domain meaNote 7:As configured acc measurements de	he aggressor A ied in OFDM sy ied in all OFDM efined in [9]. asurement reso cording to the ti efined in [7].	ymbols #0, #4, #7, #11 of I symbols of a subframe o purce restriction pattern fo me-domain measurement	a subframe overlapping overlapping with aggres r PCell measurements a t resource restriction pa	g with the sor non-ABS as defined in [7]. ttern for CSI				
Cell2 is the same	Note 8:       Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.         Note 9:       SIB-1 will not be transmitted in Cell2 in this test.							

# Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	13.3	≥2
Note 1:	The propagati	ion condit	ions for C	ell 1 and	Cell2 are	statistically indepe	endent.	•	
Note 2:	SNR correspo	onds to $\widehat{E}$	$N_{oc2}$	of cell 1.					
Note 3: Note 4:	Cell 1 Referer are transmitte	nce chanr d in the s	el is mod erving cel	ified: PDS	SCH other e when th	pply for Cell 1 and than SIB1/paging subframe is over definition of the ref	and its associa rlapped with the	ABS sub	
Note 5:						al Payload in 9 su			10ms.

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

			1					
Parameter		Unit	Cell 1	Cell 2				
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3				
	σ	dB	0	N/A				
	N <sub>oc1</sub>	dBm/15kHz	-102 (Note 2)	N/A				
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A				
	$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A				
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.2.1.3.3-4	6				
BW <sub>Channel</sub>		MHz	10	10				
Subframe Configura	ation		Non-MBSFN	MBSFN				
Cell Id			0	126				
Time Offset between	Cells	μs	2.5 (synchror	nous cells)				
ABS pattern (Note	: 5)		N/A	0001000000 010000010 0000001000 00000000				
RLM/RRM Measurement Pattern (Note 6			0001000000 010000010 0000001000 00000000	N/A				
C <sub>CSI,0</sub> CSI Subframe Sets (Note			000100000 010000010 0000001000 00000000	N/A				
7)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111110111 111111	N/A				
MBSFN Subframe Allocatio	on (Note 10)		N/A	001000 100001 000100 000000				
Number of control OFDN			2	2				
PDSCH transmission Cyclic prefix	mode		3 Normal	N/A Normal				
subframe overlap Note 3: This noise is appl Note 4: This noise is appl Note 5: ABS pattern as de MBSFN ABS subf Note 6: Time-domain mea Note 7: As configured acc measurements de Note 8: Cell 1 is the servin Cell2 is the same Note 9: SIB-1 will not be t	ping with the a ied in OFDM s ied in all OFDM afined in [9]. The frames. asurement resc cording to the ti afined in [7]. Ing cell. Cell 2 is ransmitted in C	ymbol #0 of a subframe ov I symbols of a subframe of the 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> s purce restriction pattern fo me-domain measurement is the aggressor cell. The r Cell2 in this test.	verlapping with the aggroverlapping with aggress overlapping with aggress ubframes indicated by A r PCell measurements a t resource restriction par number of the CRS port	ressor ABS. sor non-ABS. ABS pattern are as defined in [7]. ttern for CSI s in Cell1 and				
Note 11: The maximum nu	subframe allocation.							

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 2)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 FDD (Note 4)	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	12.0	≥2
Note 1:					Cell2 are s	statistically indepe	endent.	•	
Note 2:	SNR correspo	onds to $\widehat{E}$	$_{s}/N_{oc2}$ c	of cell 1.					
Note 3: Note 4:	J								
Note 5:	The maximum	n Through	put is cald	culated fro	om the tota	al Payload in 4 su	bframes, averag	ed over 4	0ms.

#### Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

# 8.2.1.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.4-2, with the addition of parameters in Table 8.2.1.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 ad Cell3.

Parame	eter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink powe allocation	r	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
		σ	dB	0	N/A	N/A
		N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna p	ort	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
		$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\widehat{E}_{s}/N$	oc2		dB	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2
BW <sub>Cha</sub>	nnel		MHz	10	10	10
Subframe Co	nfigu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	twee	n Cells	μs	N/A	3	-1
Frequency shift b	etwe	en Cells	Hz	N/A	300	-100
Cell	d			0	1	126
ABS pattern (Note 5)				N/A	11000000 11000000 11000000 11000000 11000000	1100000 1100000 1100000 1100000 1100000 1100000
RLM/RRM Measurement Subframe Pattern (Note 6)				10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Se	ets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)		C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of cor symbo		OFDM		2	Note 8	Note 8
PDSCH transm		n mode		3	Note 9	Note 9
Cyclic p Note 1: $P_p = 1$ .				Normal	Normal	Normal
Note 2: This no overlap Note 3: This no aggress Note 4: This no Note 5: ABS pa Note 6: Time-da [7] Note 7: As conf measur Note 8: The nu	ise is ping ise is sor A ise is ittern omain omain remen mber	with the ag applied in BS. applied in as defined n measurer ad according nts defined	gressor ÁBS. OFDM symbols all OFDM symbo in [9]. nent resource re g to the time-don in [7]. DFDM symbols is	#1, #2, #3, #5, #6, #8, a #0, #4, #7, #11 of a sub ols of a subframe overla striction pattern for PCe nain measurement reso s not available for ABS	oframe overlappi apping with aggree ell measurement ource restriction p	ing with the essor non-ABS s as defined in pattern for CSI
Note 9: Downlin OCNG	nk ph patte	ysical chan rn as define	nel setup in Cell ed in Annex A.5.			C.3.3 applying
				Cell 2 and Cell 3 is the	same.	

Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

ETSI

Test Numb	Refer ence	$\widehat{E}_{s}/$	N <sub>oc2</sub>	00	NG Patt	ern		opagatio		Correlatio n Matrix	Reference	e Value	UE Cate
er	Chan nel	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Antenna Configurat ion (Note 2)	Fraction of Maximu m Through put (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 FDD Note 4	9	7	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	13.9	≥2
2	R.35 FDD Note 4	9	1	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	22.6	≥2
Note 1: Note 2:										ependent.			•
Note 2:													
Note 4:	57 002												
Note 5:	The m	aximun	n Throu	ighput is	calculate	d from th	e total Pa	ayload in	9 subfrar	mes, averaged	l over 40ms.		

### Table 8.2.1.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

# 8.2.1.4 Closed-loop spatial multiplexing performance

## 8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1	Test 2	
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	0	
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98	-98	
Precoding granul	arity	PRB	6	50	
PMI delay (Note	e 2)	ms	8	8	
Reporting inter	val	ms	1	1	
Reporting mod	le		PUSCH 1-2	PUSCH 3-1	
CodeBookSubsetR on bitmap	estricti		001111	001111	
PDSCH transmis mode	sion		4	4	
Note 1: $P_{R} = 1$ .					
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).					

Table 8.2.1.4.1-1: Test Parameters for Si	ngle-Layer Spatial Multiplexing (FRC)
-------------------------------------------	---------------------------------------

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.10 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.5	≥1
2	10 MHz	R.10 FDD	OP.1 FDD	EPA5	2x2 High	70	-2.3	≥1

 Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

#### 8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1
Deurslink neuron	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{_{oc}}$ at antenna p	ort	dBm/15kHz	-98
Precoding granula	arity	PRB	6
PMI delay (Note	2)	ms	8
Reporting interv	al	ms	1
Reporting mode	e		PUSCH 1-2
CodeBookSubsetRe	estricti		000000000000000000000000000000000000000
on bitmap			00000000000000000
			00000000000000000
			111111111111111111
PDSCH transmiss	sion		4
mode			
Note 1: $P_B = 1$ .			
Note 2: If the UE r	reports	in an available uplin	k reporting instance
at subram	e SF#n	based on PMI estir	nation at a downlink
SF not late	er than	SF#(n-4), this repor	ted PMI cannot be
applied at	the eN	B downlink before S	SF#(n+4).

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Table 8.2.1.4.1A-2: Minimum	performance Single	-Layer Spatial Multi	plexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.13 FDD	OP.1 FDD	EVA5	4x2 Low	70	-3.2	≥1

### 8.2.1.4.1B Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1B-2, with the addition of the parameters in Table 8.2.1.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rankone performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.1.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission			6	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granular	ity	PRB	50	6	6
PMI delay (Note 4		ms	8	N/A	N/A
Reporting interva		ms	5	N/A	N/A
Reporting mode			PUCCH 1-1	N/A	N/A
CodeBookSubsetRestricti	on bitmap		001111	N/A	N/A
Physical channel for CQI	reporting		PUSCH(Note 6)	N/A	N/A
cqi-pmi-Configuration	Index		2	N/A	N/A
Note 1: $P_B = 1$				•	
Note 2: The respective rec	eived power	spectral density of	of each interfering	cell relative to $N_{a}$	$_{c}$ is defined by
its associated DIP Note 3: Cell 1 is the servin Note 4: If the UE reports ir at a downlink SF n before SF#(n+4).	g cell. Cell 2, an available	3 are the interferuplink reporting	ring cells. instance at subrar		

# Table 8.2.1.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Note 5: All cells are time-synchronous.

Note 6: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

#### Table 8.2.1.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	NG Pat	tern	Propagation Conditions		Correlation Reference Value Matrix and		UE Cate		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 FDD	OP. 1 FD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	0.8	≥1
Note 1:											
Note 2:	lote 2: SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.										
Note 3:									of Cell 1, Cell 2 a	nd Cell 3.	

# 8.2.1.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.4.1C-2, with the addition of parameters in Table 8.2.1.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.1.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
anocation	σ	dB	0	N/A	N/A
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.1.4.1C-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift betwe	en Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	ABS pattern (Note 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control symbols	Number of control OFDM		2	Note 8	Note 8
PDSCH transmission mode			6	Note 9	Note 9
Precoding granularity		PRB	50	N/A	N/A
PMI delay (Note 10)		ms	8	N/A	N/A
Reporting interval		ms	1	N/A	N/A
Peporting mod			PUSCH 3-1	N/A	N/A
CodeBookSubsetRestriction bitmap			1111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

Table 8.2.1.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

Note 1:	$P_B = 1$ .
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe
	overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the
	aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9].
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
	indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying
	OCNG pattern as defined in Annex A.5.
Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI
	estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at
	the eNB downlink before SF#(n+4).
Note 11:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 12:	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

#### Table 8.2.1.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

Test Number	Reference Channel	00	NG Patt	ern	Propagation Conditions (Note1)			Correlation Reference Value Matrix and			UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 FDD	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 High	70	6.1	≥2
	Note 4	FDD	FDD	FDD							
Note 1: Note 2:								ally independen cell 2 and Cell 3.			
Note 3:	SNR correspo	onds to $\hat{I}$	$\hat{E}_s / N_{oc2}$ of	of cell 1.	-						
Note 4:	Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.										
Note 5:	The maximum	n Throug	hput is ca	alculated	from the	total Pay	load in 9	subframes, ave	raged over 40ms	6.	

### 8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2, with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1-2		
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)		
	σ	dB	0		
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98		
Precoding granu	larity	PRB	50		
PMI delay (Not	e 2)	ms	8		
Reporting inte	rval	ms	1		
Reporting mo	de		PUSCH 3-1		
CodeBookSubsetRe	estriction		110000		
bitmap					
PDSCH transmission	on mode		4		
Note 1: $P_B = 1$ .					
Note 2: If the UE reports in an available uplink reporting instance					
at subrame	e SF#n bas	ed on PMI estimation	on at a downlink		
		(n-4), this reported			
applied at	the eNB do	wnlink before SF#(	n+4).		

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	UE	
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.35 FDD	OP.1 FDD	EPA5	2x2 Low	70	18.9	≥2
2	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.3	≥2

### 8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.4.3-1:	<b>Test Parameters</b>	for Multi-Laver	Spatial M	lultiplexing	(FRC)
	root r aramotoro		opanaim	and proving	(····•)

Paramete	r	Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3

$N_{_{oc}}$ at antenna port	dBm/15kHz	-98					
Precoding granularity	PRB	6					
PMI delay (Note 2)	ms	8					
Reporting interval	ms	1					
Reporting mode		PUSCH 1-2					
CodeBookSubsetRestrictio		000000000000000000000000000000000000000					
n bitmap		0000000111111111111111100					
		0000000000000					
PDSCH transmission mode		4					
Note 1: $P_B = 1$ .							
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).							
Note 3: Void.							
Note 4: Void.	Void.						
Note 5: Void.							

				Propa-	Correlation	Reference v		
Test num.	Band- width	Referencechannel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x2 Low	70	14.7	≥2
Note 1	: Void							

# Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Test 1	Test 2				
Deverliek zewer	$ ho_{\scriptscriptstyle A}$	dB	-6	-6				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)	-6 (Note 1)				
	σ	dB	3	3				
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98	-98				
Precoding granu	Ilarity	PRB	6	8				
PMI delay (Not	e 2)	ms	8	8				
Reporting inter	rval	ms	1	1				
Reporting mo	de		PUSCH 1-2	PUSCH 1-2				
CodeBookSubsetRe	estriction		00000000000000	0000000000000000000				
bitmap			0000000000000000000	0000000000000000000				
			0000001111111	0000001111111				
			1111111110000	1111111110000				
			000000000000	000000000000				
CSI request field (	Note 3)		'10'					
PDSCH transmission	on mode		4					
Note 1: $P_B = 1$ .								
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).								
Note 3: Multiple Collayers.	Multiple CC-s under test are configured as the 1 <sup>st</sup> set of serving cells by higher							
Note 4: ACK/NAC								
Note 5: The same	PDSCH tra	insmission mode is	applied to each con	nponent carrier.				

				Bropo	Correlation	Reference	e value		
Test num.	Band- width	Referencechannel	OCNG pattern	Propa- gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory	
1	2x10 MHz	R.14 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.8	≥3	
2	2x20 MHz	R.14-3 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.9	≥5	
Note 1:	lote 1: The OCNG pattern applies for each CC.								
Note 2:									
	in 8.1.2	2.3.							

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

#### 8.2.1.5 MU-MIMO

# 8.2.1.6 [Control channel performance: D-BCH and PCH]

# 8.2.1.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

#### 8.2.1.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Paramete	er	Unit	Test 1		
Deventiels newer	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
	σ	dB	0		
$\hat{E}_{s}_{-}{}^{PCell}$ at anten PCell	na port of	dBm/15kHz	-85		
$\hat{E}_{s}$ _ $SCell$ at anten Scell	na port of	dBm/15kHz	-79		
$N_{oc}$ at antenn	a port	dBm/15kHz Off (Note 2)			
Symbols for unus	ed PRBs		OCNG (Note 3)		
Modulatio	n		64 QAM		
Maximum number transmissi			1		
Redundancy versi sequence	•		{0}		
PDSCH transmiss of PCell			1		
PDSCH tramsmiss of SCell	sion mode		3		
Note 1: $P_{B} = 0$ .					
Note 2:       No external noise sources are applied         Note 3:       These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated. pseudo random data, which is QPSK modulated.         Note 4:       Void.					

Table 8.2.1.7.1-1: Test Parameters for CA

Test Number	Band- width		rence nnel	OCNG Pattern		OCNG Pattern Propagation Conditions		Correlation Matrix and Antenna				UE Category
		PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	
1	2x20M Hz	R.49 FDD	NA	OP.1 FDD	OP.5 FDD	Clause B.1	Clause B.1	1x2	2x2	85%	NA	≥5
Note 1: Note 2:	the cor	ntrol char	nnel and	PDSCH.						pattern for width comb		sed to fill s is defined

# 8.2.1.8 Intra-band non-contiguous carrier aggregation with timing offset

The requirements in this section verify the ability of an intraband non-contiguous carrier aggregation UE to demodulate the signal transmitted by the PCell and SCell in the presence of timing offset between the cells. Throughput is measured on both cells.

#### 8.2.1.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.8.1-2, with the addition of the parameters in Table 8.2.1.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Paramete	r	Unit	Test 1			
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{\scriptscriptstyle oc}$ at antenn	a port	dBm/15kHz	-98			
Modulatio	n		64 QAM			
Maximum number transmissio	••••••		4			
Redundancy version	-		{0,0,1,2}			
PDSCH transmiss of PCell	ion mode		3			
PDSCH tramsmiss of SCell	sion mode		3			
Note 1: $P_B = 1$ .	Note 1: $P_{R} = 1$ .					
Note 2: The OCI	-					

Table 8.2.1.8.1-1: Test Parameters fo	or CA	for CA	<b>Parameters</b>	Test	3.1-1:	8.2.1.	Table
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Table 8.2.1.8.1-2:	Minimum	performance	(FRC) for CA
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Test	Cell	Band-	Referenc	OCNG	Propagati	Correlati	Refence va	alue	Timing	UE
Numbe r		width	e Channel	Patter n	on Condition s	on Matrix and Antenna	Fraction of Maximum Throughput (%)	SNR (dB)	relative to PCell (µs)	Catego ry
1	PCell	10MH z	R.60 FDD	OP.1	EPA200	2x2 Low	70	21.15	N/A	2
I	SCell	10MH z	R.35-3 FDD	FDD	EPA200	2x2 Low	60	15.18	-30.26	≥3
Note 1:	1: The EPA200 propagation channels applied to PCell and SCell are statistically independent.									
Note 2:	The ap	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in								
	8.1.2.3									

# 8.2.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

Parameter	Unit	Value				
Uplink downlink configuration (Note 1)		1				
Special subframe configuration (Note 2)		4				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ processes per component carrier	Processes	7				
Maximum number of HARQ transmission		4				
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM				
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths				
Cross carrier scheduling		Not configured				
Note 1:as specified in Table 4.2-2 in TS 36.211 [4].Note 2:as specified in Table 4.2-1 in TS 36.211 [4].						

#### Table 8.2.2-1: Common Test Parameters (TDD)

# 8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

### 8.2.2.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Paramete	r	Unit	Test 1- 5	Test 6- 8	Test 9- 15	Test 16- 18	Test 19
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)

Table 8.2.2.1.1-1: Test Parameters

	σ	dB	0	0	0	0	0	
N <sub>oc</sub> at an		dBm/15kHz	-98	-98	-98	-98	-98	
Symbols			OCNG	OCNG	OCNG	OCNG	OCNG	
unused F			(Note 2)	(Note 2)	(Note 2)	(Note 2)	(Note 2)	
Modula	tion		QPSK	16QAM	64QAM	16QAM	QPSK	
ACK/NA	\CK		Multiplexing	Multiplexing	Multiplexing	Multiplexing	Multiplexing	
feedback	feedback mode							
PDSC	Н		1	1	1	1	1	
transmissio	n mode							
Note 1:	$P_B = 0$							
Note 2: T	hese phy	sical resource	blocks are ass	igned to an arl	bitrary number	of virtual UEs v	with one	
F	DSCH p	er virtual UE; t	he data transm	itted over the C	DCNG PDSCH	s shall be unco	rrelated	
p	pseudo random data, which is QPSK modulated.							
Note 3: V	oid.							
Note 4: V	'oid.							

Table 8.2.2.1.1-2:	Minimum	performance	(FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2	≥1
2	10 MHz	R.2 TDD	OP.1 TDD	ETU70	1x2 Low	70	-0.6	≥1
3	10 MHz	R.2 TDD	OP.1 TDD	ETU300	1x2 Low	70	-0.2	≥1
4	10 MHz	R.2 TDD	OP.1 TDD	HST	1x2	70	-2.6	≥1
5	1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	0.0	≥1
6	10 MHz	R.3 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	1
9	3 MHz	R.5 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥1
10	5 MHz	R.6 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	5 MHz	R.6-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
11	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
12	10 MHz	R.7 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	1
13	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	1

14	15 MHz	R.8 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	≥2
	15 MHz	R.8-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	1
15	20 MHz	R.9 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	≥3
	20 MHz	R.9-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	2
	20 MHz	R.9-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	1
16	3 MHz	R.0 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
17	10 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.0	≥1
18	20 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
19	10 MHz	R.41 TDD	OP.1 TDD	EVA5	1x2 Low	70	-5.3	≥1
Note 1:	Void							

## Table 8.2.2.1.1-3: Test Parameters for CA

	Parameter	Unit	Test 1					
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0					
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)					
	σ	dB	0					
N	$d_{oc}$ at antenna port	dBm/15kHz	-98					
Symb	ols for unused PRBs		OCNG (Note 2)					
	Modulation		QPSK					
ACK/N	ACK feedback mode		PUCCH format 1b with channel selection					
PDSC	H transmission mode		1					
Note 1:	$P_B = 0$							
Note 2:	These physical resource blo	ocks are assigne	ed to an arbitrary number of virtual UEs with one					
PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated								
	pseudo random data, which is QPSK modulated.							
Note 3:	The same PDSCH transmis	ssion mode is ap	oplied to each component carrier.					

# Table 8.2.2.1.1-4: Minimum performance (FRC) for CA

			Correlation		Correlation	Reference				
Test number	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	UE Category		
1	2x20MHz	R.42 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	-1.2	≥5		
Note 1:	The OCNG pattern applies for each CC.									
Note 2:	The applicab	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.								

- 8.2.2.1.2 Void
- 8.2.2.1.3 Void

8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Parameter		Unit	Test 1			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)			
	σ	dB	0			
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98			
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		1			
Note 1: $P_B = 0$ Note 2:The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the first slot.Note 3:The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes, QPSK modulated MBSFN data is used instead.						

Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.29 TDD	OP.3 TDD	ETU70	1x2 Low	30	2.0	≥1

# 8.2.2.2 Transmit diversity performance

### 8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$						

 Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	≥2
I.	5 MHz	R.11-2 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	1
2	10 MHz	R.10 TDD	OP.1 TDD	HST	2x2	70	-2.3	≥1

### 8.2.2.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.2.2.1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Multiplexing
PDSCH transmission	on mode		2
Note 1: $P_B = 1$			

Table 8.2.2.2.2-2: Minimum	performance Trans	smit Diversity (FRC)
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Test Band- Refere		Reference	OCNG	Propagation	Correlation	Reference	value	UE	
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	
1	1.4 MHz	R.12 TDD	OP.1 TDD	EPA5	4x2 Medium	70	0.2	≥1	
2	10 MHz	R.13 TDD	OP.1 TDD	ETU70	4x2 Low	70	-0.5	≥1	

# 8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.3-2, with the addition of parameters in Table 8.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

	Parameter		Unit	Cell 1	Cell 2
	nk downlink conf			1	1
Speci	al subframe con	figuration		4	4
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3
	nlink power location	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
		σ	dB	0	N/A
		N <sub>oc1</sub>	dBm/15kHz	-102 (Note 2)	N/A
$N_{oc}$ at	antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A
		$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A
	$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.2.3-2	6
	BW <sub>Channel</sub>		MHz	10	10
Su	ubframe Configu	ration		Non-MBSFN	Non-MBSFN
Tim	ne Offset betwee	n Cells	μs	2.5 (synch	ronous cells)
	Cell Id			0	1
/	ABS pattern (No	te 5)		N/A	0000010001 0000000001
RLM/RF	RM Measuremer Pattern (Note			0000000001 0000000001	N/A
CSI Su	bframe Sets	C <sub>CSI,0</sub>		0000010001 0000000001	N/A
	Note 7)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A
Numbe	r of control OFD	M symbols		2	2
	<pre>K/NACK feedbac</pre>			Multiplexing	N/A
PDS	SCH transmissio	n mode		2	N/A
	Cyclic prefix			Normal	Normal
Note 1: Note 2: Note 3:	subframe over This noise is a	apping with th oplied in OFD	M symbols #1, #2, #3, #5, e aggressor ABS. M symbols #0, #4, #7, #1 <sup>,</sup>		
Note 4:	the aggressor This noise is a non-ABS.	oplied in all OF	DM symbols of a subfrar	ne overlapping v	vith aggressor
Note 5: Note 6:	ABS pattern as		esource restriction patter	n for PCell meas	surements as
Note 7:			ne time-domain measuren	nent resource re	striction pattern
Note 8:	Cell 1 is the se Cell1 and Cell2	rving cell. Cell is the same.	2 is the aggressor cell. T	he number of the	e CRS ports in
Note 9:	SIB-1 will not b	e transmitted	in Cell2 in this test.		

Test Number	Reference Channel			Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference	UE Category	
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11-4 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Medium	70	3.8	≥2
Note 1:	The propagat	ion condit	ions for C	ell 1 and 0	Cell2 are	statistically indepe	endent.		
Note 2:	SNR correspo	onds to $\widehat{ ilde{E}}$	$\hat{Z}_s / N_{oc2}$ of	of cell 1.					
Note 3: Note 4:	Cell 1 Refere PDCCH/PCF	nce chanr ICH are tr	nel is mod ansmitted	ified: PDS	SCH other	oly for Cell 1 and than SIB1/paging subframe when th available in the c	and its associa e subframe is o	verlapped	
Note 5:	The maximur	n Through	put is cal	culated fro	om the tota	al Payload in 2 su	bframes, averag	ged over a	20ms.

Table 8.2.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

# 8.2.2.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.2.3A-2, with the addition of parameters in Table 8.2.2.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi			1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.2.3A-2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift betwe	en Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	e 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			0000000001 0000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		2	Note 8	Note 8
ACK/NACK feedbac	k mode		Multiplexing	N/A	N/A
PDSCH transmissio			2	Note 9	Note 9
Cyclic prefix			Normal	Normal	Normal
Note 1: $P_{B} = 1$ .					
Note 2: This noise is subframe ov	verlapping v applied in	vith the aggresso	#1, #2, #3, #5, #6, # or ABS. #0, #4, #7, #11 of a		
Note 4: This noise is	applied in		ols of a subframe ov	erlapping with age	gressor non-ABS
Note 5: ABS pattern			-tuistism of the t		at a staff of the
	n measurer	nent resource re	striction pattern for	PCell measureme	nts as defined in
			nain measurement i	esource restriction	n pattern for CSI
	of control (	OFDM symbols is	s not available for A	BS and is 2 for the	e subframe
	ysical chan	nel setup in Cell	2 and Cell 3 in acc	ordance with Anne	ex C.3.3 applying
Note 10: The number	of the CRS		Cell 2 and Cell 3 is		
Note 11: SIB-1 will no	ot be transm	illied in Cell 2 ar	nd Cell 3 in this test.		

 Table 8.2.2.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Test Number	Reference Channel					ropagati itions (N		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11-4 TDD Note	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.5	≥2
Note 1: Note 2: Note 3:	1 1 0	n matrix a	nd anten	na config				lly independent. ell 2 and Cell 3	I		
Note 4: Note 5:	transmitted in t the subframe is	the servir s availab	ng cell su le in the c	bframe w definition	hen the s	subframe ference c	is overla hannel.	ng and its associat pped with the AB subframes, averag	S subframe of ag		ell and

Table 8.2.2.2.3A-2: Minimum Performance	e Transmit Diversity (FRC)
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# 8.2.2.2.4 Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.2.2.4-2, with the addition of parameters in Table 8.2.2.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.2.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDN	l symbols		2	2	2
PDSCH transmission			2	N/A	N/A
Interference mod	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Reporting interva	al	ms	5	N/A	N/A
Reporting mode	•		PUCCH 1-0	N/A	N/A
ACK/NACK feedback			Multiplexing	N/A	N/A
Physical channel for CQI	reporting		PUSCH(Note 5)	N/A	N/A
cqi-pmi-Configuration	Index		4	N/A	N/A
Note 1: $P_{R} = 1$		•	•	•	•
Note 2: The respective rec	ceived power s	spectral density of	of each interfering	cell relative to $N_{a}$	$_{oc}$ is defined by
its associated DIP Note 3: Cell 1 is the servir Note 4: All cells are time-s Note 5: To avoid collisions instead of PUCCH periodic CQI to mu	ng cell. Cell 2, synchronous. s between CQI I. PDCCH DC	3 are the interfe I reports and HA I format 0 shall b	ring cells. RQ-ACK it is nece e transmitted in do	ownlink SF#4 and	#9 to allow

# Table 8.2.2.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

# Table 8.2.2.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel				Propagation Conditions			Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.46 TDD	OP. 1 TD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.4	≥1
								e statistically inc	dependent.		
Note 2:	SINR correspo	nds to	$\widehat{E}_{s}/N$	oc of (	Cell 1 a	s define	ed in cla	ause 8.1.1.			
Note 3:	Correlation ma	trix and	anten	na conf	iguratic	n para	meters	apply for each o	f Cell 1, Cell 2 a	nd Cell 3.	

## 8.2.2.3 Open-loop spatial multiplexing performance

# 8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas. The test coverage for different number of component carriers is defined in 8.1.2.4.

Paramete	r	Unit	Test 1-2
Downlink now or	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenn	a port	dBm/15kHz	-98
ACK/NACK feedba	ack mode		Bundling
PDSCH transmiss	ion mode		3
Note 1: $P_B = 1$			
Note 2: Void.			
Note 3: Void.			

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

Test num ber	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference v Fraction of Maximum Throughput (%)	/alue SNR (dB)	UE Cate gory
1	10 MHz	R.11-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.1	≥2
2	10 MHz	R.35 TDD	OP.1 TDD	EVA200	2x2 Low	70	20.3	≥2
3	10 MHz	R.35-2 TDD	OP.1 TDD	ETU300	2x2 Low	70	20.3	≥2
Note 1:	: Void							

Parameter		Unit	Test 1			
Develiate a surra	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		PUCCH format 1b with channel selection			
PDSCH transmission	on mode		3			
Note 1: $P_{R} = 1$						
Note 2: The same PDSCH transmission mode is applied to each component carrier.						

#### Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

					Correlation Referen		e value	
Test num ber	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	UE Category

1	2x20 MHz	R.30-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.7	≥5			
Note 1	Note 1: The OCNG pattern applies for each CC.										
Note 2	lote 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in										
	8.1.2.3.										

## 8.2.2.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Parameter		Unit	Test 1-2			
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		- (Note 2)			
PDSCH transmission	on mode		3			
Note 1: $P_B = 1$ Note 2:PUCCH format 1b with channel selection is used to feedback ACK/NACK.Note 3:For CA test cases, the same PDSCH transmission mode is applied to each component carrier.						

Table 8.2.2.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
numb er		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categ ory
1	2x20 MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.2	3
2	2x20 MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA5	2x2 Low	70	15.7	4
Note 1:	For CA test ca	ases, the OCNG	pattern applie	es for each CC.				
Note 2:								

# 8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Parameter		Unit	Test 1			
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-6			
	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)			
	σ	dB	3			
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Bundling			
PDSCH transmission	on mode		3			
Note 1: $P_B = 1$ .						

Table 8.2.2.3.2-1: Test Parameters for Large Delay CDD (FRC)

Table 8.2.2.3.2-2: Minimum	performance Large Dela	y CDD (FRC)
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[	Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
	number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
	1	10 MHz	R.14 TDD	OP.1 TDD	EVA70	4x2 Low	70	14.2	≥2

# 8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

	Parameter		Unit	Cell 1	Cell 2	
Uplin	Uplink downlink configuration			1	1	
Specia	al subframe conf	iguration		4	4	
			dB	-3	-3	
	link power ocation	$ ho_{\scriptscriptstyle B}$	dB	dB -3 (Note 1)		
		σ	dB	0	N/A	
		N <sub>oc1</sub>	dBm/15kHz	-102 (Note 2)	N/A	
N <sub>oc</sub> at a	antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	
		$N_{oc3}$	dBm/15kHz	-94.8 (Note 4)	N/A	
	$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.2.2.3.3-2	6	
	BW <sub>Channel</sub>		MHz	10	10	
Su	bframe Configur	ation		Non-MBSFN	Non-MBSFN	
	Cell Id			0	1	
Time	e Offset betweer	n Cells	μs	2.5 (synchror	nous cells)	
A	BS pattern (Note	e 5)		N/A	0000010001, 0000000001	
RLM/RRM Measurement Subframe Pattern (Note 6)				0000000001, 0000000001	N/A	
CSI Sul	oframe Sets	C <sub>CSI,0</sub>		0000010001, 0000000001	N/A	
(N	lote 7)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A	
Number	of control OFD	A symbols		2	2	
ACK	NACK feedback	mode		Multiplexing	N/A	
PDS	CH transmissior	n mode		3	N/A	
	Cyclic prefix			Normal	Normal	
<ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.</li> <li>Note 5: ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> <li>Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1</li> </ul>						
Note 9:	and Cell2 is the SIB-1 will not be		in Cell2 in this test.			

# Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) (Note 5)	SNR (dB) (Note 2)	
1	R.11 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	14.0	≥2
Note 1:					Cell2 are s	statistically indepe	ndent.		
Note 2:	SNR corresp	onds to $\widehat{E}$	$\hat{E}_s / N_{oc2}$ of	of cell 1.					
Note 3: Note 4:	The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.								
Note 5:	The maximur	n Through	put is cale	culated fro	om the tota	al Payload in 2 sul	bframes, averag	ged over	20ms.

# Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2			
Uplink downlink config			1	1			
Special subframe conf	iguration		4	4			
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)			
	σ	dB	0	N/A			
	N <sub>oc1</sub>	dBm/15kHz	-102 (Note 2)	N/A			
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A			
	N <sub>oc3</sub>	dBm/15kHz	-94.8 (Note 4)	N/A			
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.3.3-4	6			
BW <sub>Channel</sub>		MHz	10	10			
Subframe Configur	ation		Non-MBSFN	MBSFN			
Cell Id			0	126			
Time Offset betweer	n Cells	μs	2.5 (synchro	nous cells)			
ABS pattern (Not	e 5)		N/A	0000000001 0000000001			
RLM/RRM Measurement Pattern (Note 6			0000000001 0000000001	N/A			
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A			
(Note 7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A			
MBSFN Subframe Alloca 10)	ation (Note		N/A	000010			
Number of control OFD	A symbols		2	2			
ACK/NACK feedback	k mode		Multiplexing	N/A			
PDSCH transmission	n mode		3	N/A			
Cyclic prefix			Normal	Normal			
#13 of a subfrai	ne overlappir	ig with the aggresso	3, #4, #5, #6, #7, #8, #9 or ABS. bframe overlapping with				
	plied in all OF	DM symbols of a si	ubframe overlapping wit	th aggressor non-			
		. The 10 <sup>th</sup> and 20 <sup>th</sup> s	subframes indicated by	ABS pattern are			
		esource restriction	pattern for PCell measu	rements as defined			
Note 7: As configured a			surement resource rest	riction pattern for			
Note 8: Cell 1 is the ser	<ul> <li>CSI measurements defined in [7].</li> <li>8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.</li> </ul>						
Note 9: SIB-1 will not be	e transmitted me Allocation	in Cell2 in this test. as defined in [7], or	ne frame with 6 bits is cl	hosen for MBSFN			

# Table 8.2.2.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Conditions Matrix a		Correlation Matrix and Antenna	Reference	UE Category	
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5)	SNR (dB) (Note 2)	
1	R.11 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	12.2	≥2
Note 1:					Cell2 are s	statistically indepe	ndent.		
Note 2:	SNR corresp	onds to $\widehat{E}$	$\hat{Z}_s / N_{oc2}$ of	of cell 1.					
Note 3: Note 4:	3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.								
Note 5:		00				al Payload in 2 sul			

# 8.2.2.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.4-2, with the addition of parameters in Table 8.2.2.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Paramete		Unit	Cell 1	Cell 2	Cell 3	
Uplink downlink con	Uplink downlink configuration		1	1	1	
Special subframe co	nfiguration		4	4	4	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	N/A	N/A	
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A	
$N_{oc}$ at antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A	
	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 4)	N/A	N/A	
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2	
BW <sub>Channel</sub>		MHz	10	10	10	
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset betwe	en Cells	μs	N/A	3	-1	
Frequency shift betw	een Cells	Hz	N/A	300	-100	
Cell Id			0	1	126	
ABS pattern (Ne	-		N/A	0000000001 0000000001	0000000001 0000000001	
	RLM/RRM Measurement Subframe Pattern (Note 6)		0000000001 0000000001	N/A	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A	
(Note7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A	
Number of contro symbols	OFDM		2	Note 8	Note 8	
ACK/NACK feedba	ck mode		Multiplexing	N/A	N/A	
PDSCH transmissi	on mode		3	Note 9	Note 9	
Cyclic prefi	x		Normal	Normal	Normal	
<ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 5: ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> <li>Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.</li> </ul>						
<ul> <li>Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.</li> <li>Note 10: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.</li> <li>Note 11: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.</li> </ul>						

Test Num	Refer ence	$\hat{E}_s/s$	N <sub>oc2</sub>	00	NG Patt	ern	Propagation Conditions (Note1)			Correlation Matrix and			UE Cate
ber	Chan nel	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughp ut (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD Note 4	9	7	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	14.2	≥2
2	R.35 TDD Note 4	9	1	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	22.7	≥2
Note 1:										pendent.			
Note 2:				$\hat{E}_{s}/N_{oc2}$			apply to	r Cell 1,	Cell 2 and	d Cell 3.			
Note 3:				57 002									
Note 4:	Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.												
Note 5:	The n	naximun	n Throu	ghput is c	alculated	from the	total Pa	yload in 2	2 subfram	es, averaged ov	/er 20ms.		

### Table 8.2.2.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

# 8.2.2.4 Closed-loop spatial multiplexing performance

# 8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1	Test 2			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)			
	σ	dB	0	0			
$N_{\scriptscriptstyle oc}$ at antenna po	ort	dBm/15kHz	-98	-98			
Precoding granular	ity	PRB	6	50			
PMI delay (Note 2	2)	ms	10 or 11	10 or 11			
Reporting interva		ms	1 or 4 (Note 3)	1 or 4 (Note 3)			
Reporting mode			PUSCH 1-2	PUSCH 3-1			
CodeBookSubsetRest	riction		001111	001111			
bitmap							
ACK/NACK feedback	mode		Multiplexing	Multiplexing			
PDSCH transmission	mode		4	4			
Note 1: $P_B = 1$ .							
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).							
Note 3: For Uplink - c and 4ms.	lownlink	configuration 1 the rep	orting interval will alte	ernate between 1ms			

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.10 TDD	OP.1 TDD	EVA5	2x2 Low	70	-3.1	≥1
2	10 MHz	R.10 TDD	OP.1 TDD	EPA5	2x2 High	70	-2.8	≥1

 Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

#### 8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1			
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-6			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)			
	σ	dB	3			
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98			
Precoding granul	arity	PRB	6			
PMI delay (Note	e 2)	ms	10 or 11			
Reporting inter-	val	ms	1 or 4 (Note 3)			
Reporting mod	le		PUSCH 1-2			
CodeBookSubsetR	estricti		00000000000000000			
on bitmap			00000000000000000			
			0000000000000111			
			1111111111111			
ACK/NACK feed	oack		Multiplexing			
mode						
PDSCH transmis	sion		4			
mode						
Note 1: $P_B = 1$ .						
Note 2: If the UE	reports	in an available up	link reporting instance			
			timation at a downlink			
SF not la	ter than	SF#(n-4), this rep	orted PMI cannot be			
	applied at the eNB downlink before SF#(n+4).					
			1 the reporting interval			
		ween 1ms and 4m				

Table 8.2.2.4.1A-2: Minimum performance	Single-Layer	<sup>r</sup> Spatial Multiplexing (F	RC)
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Test	Bandwidth Refe	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.13 TDD	OP.1 TDD	EVA5	4x2 Low	70	-3.5	≥1

# 8.2.2.4.1B Enhanced Performance Requirement Type A – Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1B-2, with the addition of the parameters in Table 8.2.2.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-

one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.2.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference
model

Parameter	Parameter		Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW <sub>Channel</sub>		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission			6	N/A	N/A
Interference mode	əl		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granula	rity	PRB	50	6	6
PMI delay (Note 4	4)	ms	10 or 11	N/A	N/A
Reporting interva	Reporting interval			N/A	N/A
Reporting mode			PUCCH 1-1	N/A	N/A
CodeBookSubsetRestricti		001111	N/A	N/A	
ACK/NACK feedback		Multiplexing	N/A	N/A	
Physical channel for CQI	reporting		PUSCH(Note 6)	N/A	N/A
cqi-pmi-Configuration	Index		4	N/A	N/A
Note 1: $P_{B} = 1$					

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{ac}$  is defined by its associated DIP value as specified in clause B.5.1.

Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. Note 3:

If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation Note 4: at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH Note 6: instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

### Table 8.2.2.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	NG Pat	tern	Propagation Conditions		Correlation Matrix and	Reference	Value	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 TDD	OP. 1 TD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	1.1	≥1
Note 1:	······································										
Note 2: SINR corresponds to $\hat{E}_s / N_{oc}$ of Cell 1 as defined in clause 8.1.1.											
Note 3:	Correlation ma	trix and	anten	na conf	iguratio	n para	meters	apply for each o	of Cell 1, Cell 2 a	nd Cell 3.	

# 8.2.2.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.4.1C-2, with the addition of parameters in Table 8.2.2.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

	Parameter		Unit	Cell 1	Cell 2	Cell 3	
	wnlink confi			1	1	1	
Special su	ubframe con	figuration		4	4	4	
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
	Downlink power allocation		dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	
		σ	dB	0	N/A	N/A	
		N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A	
$N_{oc}$ at and	tenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	N/A	
		$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A	
	$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.2.2.4.1C-2	12	10	
	BW <sub>Channel</sub>		MHz	10	10	10	
Subfra	me Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Of	ffset betwee	n Cells	μs	N/A	3	-1	
Frequenc	y shift betwe	en Cells	Hz	N/A	300	-100	
	Cell Id			0	126	1	
ABS	pattern (Not	te 5)		N/A	0000000001 0000000001	0000000001 0000000001	
	RM Measur ne Pattern (I			0000000001 0000000001	N/A	N/A	
CSI Subfr		C <sub>CSI,0</sub>		000000001 0000000001	N/A	N/A	
(Not		C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A	
Numbe	er of control ( symbols	OFDM		2	Note 8	Note 8	
ACK/N/	ACK feeback	mode		Multiplexing	N/A	N/A	
	transmissio			6	Note 9	Note 9	
	oding granul		PRB	50	N/A	N/A	
	delay (Note		ms	10 or 11	N/A	N/A	
	porting interv		ms	1 or 4 (Note 11)	N/A	N/A	
	porting mod			PUSCH 3-1	N/A	N/A	
	okSubsetRe			1111	N/A	N/A	
(	bitmap Cyclic prefix			Normal	Normal	Normal	
Note 1:	$P_{B}=1.$		OFDM symbols	#1, #2, #3, #5, #6, #8, ;			
Note 3:		s applied in	gressor ABS. OFDM symbols	#0, #4, #7, #11 of a sul	oframe overlappi	ing with the	
			all OFDM symbo	ols of a subframe overla	pping with agor	essor non-ABS	
	ABS pattern						
Note 6:	Time-domai			striction pattern for PCe	ell measurement	s as defined in	
Note 7:				nain measurement reso	ource restriction	pattern for CSI	
Note 8:							
Note 9:		iysical chan	nel setup in Cell	2 and Cell 3 in accorda	ance with Annex	C.3.3 applying	
Note 10:	If the UE rep	ports in an a		eporting instance at sul			
1	the eNB dov	vnlink befor	e SF#(n+4).	an SF#(n-4), this reported			
	For Uplink - 4ms.	downlink co	onfiguration 1 the	e reporting interval will a	alternate betwee	n 1ms and	

#### Table 8.2.2.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Test Number	Reference Channel	00	NG Patt	ern		Propagation Conditions (Note1)		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 High	70	6.4	≥2
	Note 4	TDD	FDD	TDD							
Note 1:	The propagation	on conditi	ons for C	ell 1, Cel	ll 2 and C	ell 3 are	statistical	lly independent.			
Note 2:	The correlation	n matrix a	nd anten	na config	juration a	pply for C	Cell 1, Ce	Il 2 and Cell 3.			
Note 3:	SNR correspor	nds to $\widehat{E}_s$	$/N_{oc2}$ of	cell 1.							
Note 4:	4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.										
Note 5:	The maximum	Through	put is cale	culated fr	rom the to	otal Paylo	ad in 2 s	ubframes, average	ed over 20ms.		

#### Table 8.2.2.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)– Non-MBSFN ABS

#### 8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Parameter		Unit	Test 1-2		
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)		
	σ	dB	0		
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98		
Precoding granu	Ilarity	PRB	50		
PMI delay (Not	e 2)	ms	10 or 11		
Reporting inte	rval	ms	1 or 4 (Note 3)		
Reporting mo	de		PUSCH 3-1		
ACK/NACK feedba	ck mode		Bundling		
CodeBookSubsetR	estriction		110000		
bitmap					
PDSCH transmission	on mode		4		
Note 1: $P_B = 1$ .					
<ul> <li>Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 3: For Uplink - downlink configuration 1 the reporting interval</li> </ul>					
		1ms and 4ms.	reporting interval		

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

#### Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Tes	t Band-	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE
numb	er width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.35 TDD	OP.1 TDD	EPA5	2x2 Low	70	19.5	≥2
2	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Low	70	13.9	≥2

#### 8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.4.3-4, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.4.3-1: Test Parameters	for Multi-Layer	Spatial Multiplexing (FRC)
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Paramete	r	Unit	Test 1		
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
$N_{\scriptscriptstyle oc}$ at antenn	a port	dBm/15kHz	-98		
Precoding gran	ularity	PRB	6		
PMI delay (No	ote 2)	ms	10 or 11		
Reporting inte	erval	ms	1 or 4 (Note 3)		
Reporting m	ode		PUSCH 1-2		
ACK/NACK feedba	ack mode		Bundling		
CodeBookSubsetF	Restriction		000000000000000000000000000000000000000		
bitmap			0000011111111111111111000000		
			000000000		
PDSCH transmiss	ion mode		4		
Note 1: $P_B = 1$ .					
Note 2: If the UE reports in an available uplink reporting instance at subrame SF# based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)					
Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.					
Note 4: Void.	Note 4: Void.				
Note 5: Void.					
Note 6: Void.					

#### Table 8.2.2.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagatio	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.36 TDD	OP.1 TDD	EPA5	4x2 Low	70	15.7	≥2
Note 1:	Void							

#### Table 8.2.2.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Test 1
Develielenewer	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3

$N_{oc}$ at an	ntenna port	dBm/15kHz	-98				
Precoding	granularity	PRB	8				
PMI dela	ay (Note 2)	ms	10 or 11				
Reportir	ng interval	ms	1 or 4 (Note 3)				
Reporti	ing mode		PUSCH 1-2				
ACK/NACK f	eedback mode		PUCCH format 1b with channel selection				
CodeBookSu	bsetRestriction		000000000000000000000000000000000000000				
bit	map		0000111111111111111100000000				
			0000000				
CSI request	field (Note 4)		'10'				
PDSCH trans	smission mode		4				
Note 1: $P_B$ =	=1.						
base							
betv							
	Note 4: Multiple CC-s under test are configured as the 1 <sup>st</sup> set of serving cells by high layers.						
Note 5: The	same PDSCH tra	Insmission mode is	applied to each component carrier.				

#### Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

Test	Band-	Reference	OCNG	Propagatio	Correlation	Reference	ce value	UE Cate	
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)		
1	2x20 MHz	R.43 TDD	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	11.1	≥5	
Note 1: Note 2:		pattern applies bility of requiren		ent CA configur	ations and bandw	idth combination	sets is defined i	n 8.1.2.3.	

### 8.2.2.5 MU-MIMO

### 8.2.2.6 [Control channel performance: D-BCH and PCH]

### 8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

#### 8.2.2.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Paramete	er	Unit	Test 1		
	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
	σ	dB	0		
$\hat{E}_{s}_{-}{}^{PCell}$ at anter PCell	nna port of	dBm/15kHz	-85		
$\hat{E}_{s}$ _ $SCell$ at anter Scell	ina port of	dBm/15kHz	-79		
$N_{oc}$ at antenn	a port	dBm/15kHz	Off (Note 2)		
Symbols for unus	ed PRBs		OCNG (Note 3)		
Modulatio	n		64 QAM		
Maximum number transmissi			1		
Redundancy versi sequence	•		{0}		
PDSCH transmiss of PCell	sion mode		1		
PDSCH transmiss of SCell			3		
Note 1: $P_{B} = 0$ .					
Note 2:       No external noise sources are applied.         Note 3:       These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data.         Note 4:       Void.					

Table 8.2.2.7.1-1: Test Parameters for CA

Test Number	Band- width	Reference Channel		OCNG Pattern			Propagation Conditions		Correlation Matrix and Antenna		ce value ion of mum hput (%)	UE Category
		PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	PCell	SCell	
1	2x20M Hz	R.49 TDD	NA	OP.1 TDD	OP.5 TDD	Clause B.1	Clause B.1	1x2	2x2	85%	NA	≥5
Note 1: Note 2:	the cor	OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill control channel and PDSCH. applicability of requirements for different CA configurations and bandwidth combination sets is defined										

# 8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

### 8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRG for Transmission mode 9 and 10 Time domain: 1 ms
Note 1: Void. Note 2: Void.		

#### Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

#### 8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

parameter		Unit	Test 1	Test 2	
	$ ho_{\scriptscriptstyle A}$	dB	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
	σ	dB	-3	-3	
Beamforming mo	del		Annex B.4.1	Annex B.4.1	
Cell-specific refere signals	ence		Antenna	ports 0,1	
CSI reference sig	nals		Antenna ports 15,,18	Antenna ports 15,,18	
CSI-RS periodicity subframe offse <i>T</i> <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	t s	Subframes	5/2	5/2	
CSI reference sig configuration	nal		0	3	
Zero-power CSI- configuration <i>I</i> <sub>CSI-RS</sub> / <i>ZeroPowerCSI-F</i> bitmap		Subframes / bitmap	3 / 00010000000000000000	3 / 0001000000000000	
$N_{_{oc}}$ at antenna p	ort	dBm/15kHz	-98	-98	
Symbols for unus PRBs	ed		OCNG (Note 4)	OCNG (Note 4)	
Number of alloca resource blocks (No		PRB	50	50	
Simultaneous transmission			No	Yes (Note 3, 5)	
PDSCH transmiss mode	sion		9	9	
<ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.</li> <li>Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.</li> <li>Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPS modulated.</li> </ul>					
			ties $n_{\rm SCID}$ are set to 0		
DM RS w	ith inte	rrering simultai	neous transmission test	t cases.	

#### Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.43 FDD	OP.1 FDD	EVA5	2x2 Low	70	-1	≥1

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE		
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
2	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x2 Low	70	21.9	≥2		
Note 1:										

### Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

# 8.3.1.1A Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1A-2, with the addition of the parameters in Table 8.3.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.1.1A-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

paramete	r	Unit	Cell 1	Cell 2
Davaslinkara	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	ice signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s	signals		Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset T <sub>CSI</sub>	-rs / $\Delta$ csi-rs	Subframes	5 / 2	N/A
CSI reference configuration			0	N/A
$N_{_{oc}}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note :	2)	dB	N/A	-1.73
BW <sub>Channel</sub>		MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	126
Number of contro symbols	I OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming r	nodel		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference m	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	Ms	8	N/A
Reporting inte	erval	Ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetF bitmap	Restriction		0000000000000000 0000000000000000 000000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous transmission			No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting	for CQI		PUSCH(Note 8)	N/A
cqi-pmi-Configura	tionIndex		5	N/A
$N_{oc}$ ´ is c Note 3: The mode	lefined by its	associated DI	tral density of each inter P value as specified in c al under test in Cell 1 are	lause B.5.1.

# Table 8.3.1.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

## Table 8.3.1.1A-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference Value		UE Categor
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	У
1	R.48 FDD	OP.1 FDD	N/A	EVA5	EVA5	4x2 Low	70	-1.1	≥1
Note 1:							ly independent.		
Note 2:	SINR corres	SINR corresponds to $\widehat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.							
Note 3:	Correlation	matrix ar	nd antenr	na configu	uration pa	arameters appl	y for each of Cell 1	and Cell 2	

# 8.3.1.1B Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.1.1B -2, with the addition of parameters in Table 8.3.1.1B -1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.1.1B -1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)
anocation	σ	dB	-3	N/A	N/A
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 3)	N/A	N/A
	$N_{oc3}$	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift betwe	en Cells	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific reference	e signals		A	ntenna ports 0,1	
CSI reference sig	Inals		Antenna ports 15,16	N/A	N/A
CSI-RS periodicity subframe offse <i>T</i> <sub>CSI-RS</sub> / Δ <sub>CSI-R</sub>	et	Subframes	5/2 N/A		N/A
CSI reference sig configuration			8	N/A	N/A
Zero-power CSI- configuration	-RS	Subframes / bitmap	[3 / 0010000000000 00]	N/A	N/A
ABS pattern (Not	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control OFDM symbols			2	Note 8	Note 8
PDSCH transmissio	n mode		TM9-1layer	Note 9	Note 9
Precoding granularity			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming mo			Annex B.4.1	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

### Table 8.3.1.1B-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Note 1:	$P_B = 1$ .
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a
	subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the
Note 4	aggressor ABS. This point is applied in all OEDM symbols of a subframe symplection with aggregater part
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non- ABS.
Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is
	overlapped with the ABS subframe of aggressor cell and the subframe is available in the
	definition of the reference channel.
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined
	in [7].
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
Note 0.	indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3
	applying OCNG pattern as defined in Annex A.5.
Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI
	estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at
	the eNB downlink before SF#(n+4).
	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 12:	
Note 13:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.1.1B-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Test Number	Reference Channel	00	NG Patt	ern	Propagation Conditions (Note1)		Correlation Reference Value Matrix and			UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.51 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5		2x2 Low	70	7.8	≥2	
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.										

### 8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

#### Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

noromotor		Unit	Test 1			
parameter		Unit	Cell 1	Cell 2		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	4	0		
	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0		
	σ	dB	-3	-3		

Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1				
Cell ID		0	126				
CSI reference signals		Antenna ports 15,16	NA				
Beamforming model		Annex B.4.2	NA				
CSI-RS periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	5/2	NA				
CSI reference signal configuration		8	NA				
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	3 / 001000000000000000	NA				
$N_{_{oc}}$ at antenna port	dBm/15kHz	-98	-98				
$\widehat{E}_s/N_{oc}$		Reference Value in Table 8.3.1.2-2	7.25dB				
Symbols for unused PRBs		OCNG (Note 2)	NA				
Number of allocated resource blocks (Note 2)	PRB	50	NA				
Simultaneous transmission		No	NA				
PDSCH transmission mode		9	Blanked				
Note 1: $P_B = 1$ Note 2:These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.							

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel			Correlation Reference value Matrix and			UE Categ		
			Cell1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	ory
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	N/A	ETU5	ETU5	2x2 Low	70	[14.2]	2-8
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1 and Cell 2 are statistically independent. Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2. SNR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1.									

# 8.3.1.3 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.1.3.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.1-3, with the additional parameters in Table 8.3.1.3.1-1 and Table 8.3.1.3.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.1.3.1-2. In Table 8.3.1.3.1-1 and 8.3.1.3.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2

(TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Paramete	r	Unit	TP 1	TP 2				
Downlink power $\rho_A$		dB	0	0				
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0				
	σ	dB	-3	-3				
Cell-specific referer	nce signals		Antenna ports 0,1	(Note 2)				
CSI-RS 0 anteni	na ports		NA	Port {15,16}				
<i>qcl-CSI-RS-Configl</i> CSI-RS 0 period subframe offset <i>T</i> <sub>CS</sub>	icity and $_{-RS} / \Delta_{CSI-RS}$	Subframes	NA	5/2				
qcl-CSI-RS-Configl CSI-RS 0 config			NA	8				
csi-RS-ConfigZPId power CSI-RS 0 co I <sub>CSI-RS</sub> / ZeroPower CSI-R	<i>-r11,</i> Zero- nfiguration		NA	2/ 000001000000000				
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	-98				
$\widehat{E}_{s}/N_{oc}$		dB	Reference point in Table 8.3.1.3.1-3	Reference point in Table 8.3.1.3.1-3				
BW <sub>Channe</sub>	I	MHz	10	10				
Cyclic Pret	ïx	Normal		Normal				
Cell Id			0	0				
Number of contro symbols	OFDM		2	2				
PDSCH transmiss	ion mode		Blanked	10				
Number of alloca	ted PRB	PRB	NA	50				
<i>qcl-Operation, '</i> PE Mapping and Qu Location Indic	iasi-Co-		Туре	B, '00'				
Time offset betwe	een TPs	μs	NA	Reference point in Table 8.3.1.3.1-3				
Frequency error be	tween TPs	Hz	NA	0				
Beamforming	model		NA	Port 7 as specified in clause B.4.1				
Symbols for unus	ed PRBs		NA	OCNG (Note 3)				
Note 1: $P_B = 1$								
Note 1: $F_B = 1$ Note 2: REs for antenna ports 0 and 1 have zero transmission power. Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.								

Table 8.3.1.3.1-1: Test Parameters for quasi co-location type B: same Cell ID
-------------------------------------------------------------------------------

#### Table 8.3.1.3.1-2 Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Test Reference Number Channe		OGCN pattern		Time offset between	Propagation Conditions (Note1)		Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 FDD	NA	OP.1 FDD	2	EPA5	EPA5	2x2 Low	70	12.1	≥2
2	R.52 FDD	NA	OP.1 FDD	-0.5	EPA5	EPA5	2x2 Low	70	12.6	≥2
Note 1: Note 2: Note 3:	Iote 1:       The propagation conditions for TP 1 and TP 2 are statistically independent.         Iote 2:       The correlation matrix and antenna configuration apply for TP 1 and TP 2.									

#### 8.3.1.3.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.1.3.2-3, with the additional parameters in Table 8.3.1.3.2-1 and 8.3.1.3.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In 8.3.1.3.2-1 and 8.3.1.3.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

paramete	r	Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals		Antenna ports 0,1	(Note 2)
CSI reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	5/2	N/A
CSI reference signal 0 configuration		0	N/A
CSI reference signals 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	N/A	5/2
CSI reference signal 1 configuration		N/A	8
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	2/ 00100000000000000000	N/A
Zero-power CSI-RS1 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap <sub>S</sub>	Subframes /bitmap	N/A	2/ 000001000000000
$\widehat{E}_{s}/N_{oc}$	dB	Reference Value in Table 8.3.1.3.2-3	Reference Value in Table 8.3.1.3.2-3
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98
BW <sub>Channel</sub>	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	0
Number of control OFDM symbols		2	2
Timing offset between TPs		N/A	Reference Value ir Table 8.3.1.3.2-3
Frequency offset between TPs	Hz	N/A	0
Number of allocated resource blocks	PRB	50	50
PDSCH transmission mode		10	10
Probability of occurrence of PDSCH transmission(Note 3)	%	30	70
Symbols for unused PRBs		OCNG (Note 4)	OCNG (Note 4)

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

PQI set index	Parameter	Parameters in each PQI set					
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2			
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked			
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH			

#### Table 8.3.1.3.2-2 Configurations of PQI and DL transmission hypothesis for each PQI set

#### Table 8.3.1.3.2-3 Performance Requirements for timing offset compensation with DPS transmission

Test Number	Timing offset(us)	Reference Channel		OCNG Propagation Pattern Conditions		Correlation Reference Value Matrix and			UE Category	
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	2	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.2	≥2
2	-0.5	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.5	≥2
Note 1: Note 2: Note 3:	<ul> <li>The propagation conditions for TP 1 and TP 2 are statistically independent.</li> <li>Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.</li> </ul>									

#### 8.3.1.3.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.3-2, with the additional parameters in Table 8.3.1.3.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In 8.3.1.3.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

parameter		Unit	TP 1	TP 2
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		N/A	As specified in clause B.4.2				
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1				
CSI reference signals 0		N/A	Antenna ports {15,16}				
CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	N/A	5/2				
CSI reference signal 0 configuration		N/A	0				
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	2/ 00100000000000000				
$\widehat{E}_s/N_{oc}$	dB	Reference point in Table 8.3.1.3.3-2 + 4dB	Reference Value in Table 8.3.1.3.3-2				
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98				
BW <sub>Channel</sub>	MHz	10	10				
Cyclic Prefix		Normal	Normal				
Cell Id		0	126				
Number of control OFDM symbols		1	2				
Timing offset between TPs	us	N/A	0				
Frequency offset between TPs	Hz	N/A	200				
<i>qcl-Operation, '</i> PDSCH RE Mapping and Quasi-Co- Location Indicator'		Туре	B, '00'				
PDSCH transmission mode		Blank	10				
Number of allocated resource block		N/A	50				
Symbols for unused PRBs		N/A	OCNG(Note2)				
Note 1: $P_B = 1$ Note 2:       These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.							

 Table 8.3.1.3.3-2 Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

Test Number	Reference Channel		NG tern	Cond	gation itions te1)	Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 FDD	N/A	OP.1 FDD	EPA5	ETU5	2x2 Low	70	14.4	≥2
Note 1: Note 2: Note 3:	The propagation conditions for TP 1 and TP 2 are statistically independent. Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2. SNR corresponds to $\hat{E}_s/N_{oc}$ of TP 2 as defined in clause 8.1.1.								

### 8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value
Uplink downlink configuration (Note 1)		1
Special subframe configuration (Note 2)		4
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	7
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission mode 9 and 10Time domain: 1 ms
ACK/NACK feedback mode		Multiplexing
	Table 4.2-2 in TS 36. Table 4.2-1 in TS 36.	

### 8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	
	σ	dB	0	0	0	0	
Cell-specific refere signals	ence			Antenn	a port 0		
Beamforming mo	del			Annex	(B.4.1		
$N_{_{oc}}$ at antenna p	oort	dB/15kHz	-98	-98	-98	-98	
Symbols for unused	PRBs		OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	
PDSCH transmiss mode	sion		7	7	7	7	
Note 1: $P_{B} = 0$ .							
Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.							

Table 8.3.2.1-1: Test Parameters for Testing DRS

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.25 TDD	OP.1 TDD	EPA5	2x2 Low	70	-0.8	≥1
2	10 MHz 16QAM 1/2	R.26 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	≥2
	5MHz 16QAM 1/2	R.26-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	1
3	10 MHz 64QAM 3/4	R.27 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	≥2
	10 MHz 64QAM 3/4	R.27-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	1
4	10 MHz 16QAM 1/2	R.28 TDD	OP.1 TDD	EPA5	2x2 Low	30	1.7	≥1

Table 8.3.2.1-2: Minimum performance DRS (FRC)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	Test 5
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3	-3	-3	-3
Cell-specific reference signals	e			Antenna p	port 0 and ant	enna port 1	
Beamforming mode					Annex B.4.1		
$N_{\scriptscriptstyle oc}$ at antenna por	t	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for unused Pl	Symbols for unused PRBs			OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)
Simultaneous transmis	sion		(Note 4) No	No	No	Yes (Note 3, 5)	Yes (Note 3, 5)
PDSCH transmission m	node		8	8	8	8	8
<ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.</li> <li>Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.</li> <li>Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.</li> </ul>							
							nterfering

 Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

Test			OCNG	Propagation	Correlation	Reference	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	-1.0	≥1
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	≥2
	5MHz 16QAM 1/2	R.32-1 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	1
3	10 MHz 64QAM 3/4	R.33 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	≥2
	10 MHz 64QAM 3/4	R.33-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	1

### Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

# Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
4	10 MHz	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.9	≥2
	16QAM 1/2	(Note 1)						
5	10 MHz	R.34 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.0	≥2
	64QAM 1/2	(Note 1)						
Note 1:	The reference of	channel applie	s to both the i	input signal und	er test and the inte	rfering signal.		

### 8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Parameter		Unit	Test 1	Test 2
Davaslintenar	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)
	σ	dB	-3	-3
Cell-specific refere signals	nce			ports 0,1
CSI reference sigr	nals		Antenna ports 15,,22	Antenna ports 15,,18
Beamforming mo	del		Annex B.4.1	Annex B.4.1
CSI-RS periodicity subframe offse <i>T</i> <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	t	Subframes	5 / 4	5 / 4
CSI reference sig configuration			1	3
Zero-power CSI-f configuration <i>I</i> <sub>CSI-RS</sub> / <i>ZeroPowerCSI-F</i> bitmap		Subframes / bitmap	4 / 0010000100000000	4 / 00100000000000000
$N_{\scriptscriptstyle oc}$ at antenna p		dBm/15kHz	-98	-98
Symbols for unus PRBs	ed		OCNG (Note 4)	OCNG (Note 4)
Number of allocat resource blocks (No		PRB	50	50
Simultaneous transmission			No	Yes (Note 3, 5)
PDSCH transmiss mode	ion		9	9
Note 3: Modulatio port (7 or Note 4: These phy virtual UE	3. n symt 8) not ysical r s with SSCHs	ools of an inter used for the in esource blocks one PDSCH pe	signal under test are m ference signal is mappe put signal under test. s are assigned to an art er virtual UE; the data to rrelated pseudo random	ed onto the antenna bitrary number of ransmitted over the
			ties $n_{ m SCID}$ are set to 0 neous transmission test	

## Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	Reference	rence OCNG Propagation Correlation		Correlation	Reference	UE	
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.50 TDD	OP.1 TDD	EVA5	2x2 Low	70	-0.6	≥1

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	value	UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category			
2	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.1	≥2			
Note 1:											

### Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

# 8.3.2.1B Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.2.1B-2, with the addition of the parameters in Table 8.3.2.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.2.1B-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

paramete	r	Unit	Cell 1	Cell 2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referen	ice signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s	<u> </u>		Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset T <sub>CSI</sub>	-rs / $\Delta$ csi-rs	Subframes	5 / 4	N/A
CSI reference configuration			0	N/A
$N_{\scriptscriptstyle oc}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note	2)	dB	N/A	-1.73
BW <sub>Channel</sub>		MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	126
Number of contro symbols	I OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming r	nodel		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference m	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	ms	10 or 11	N/A
Reporting inte	erval	ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetF bitmap	Restriction		0000000000000000 0000000000000000 000000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous transmission			No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting	for CQI		PUSCH(Note 8)	N/A
cqi-pmi-Configura	tionIndex		4	N/A
$N_{oc}$ is c Note 3: The mode	lefined by its	associated D	tral density of each inter P value as specified in c al under test in Cell 1 are	lause B.5.1.

# Table 8.3.2.1B-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

Table 8.3.2.1B-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9
interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference Value						UE Categor
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	у				
1	R.48 TDD	OP.1 TDD	N/A	EVA5	EVA5	4x2 Low	70	-1.0	≥1				
Note 1:		e propagation conditions for Cell 1 and Cell 2 are statistically independent.											
Note 2:	SINR corres	corresponds to $ \widehat{E}_{s} ig / N_{oc}   $ of Cell 1 as defined in clause 8.1.1.											
Note 3:	Correlation	matrix ar	d antenr	na configu	uration pa	arameters appl	y for each of Cell 1	and Cell 2					

# 8.3.2.1C Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.2.1.C -2, with the addition of parameters in Table 8.3.2.1.C -1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.2.1.C -1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Configuration			1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)
anooation	σ	dB	-3	N/A	N/A
	N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 4)	N/A	N/A
$\widehat{E}_{s}/N_{oc2}$	1	dB	Reference Value in Table 2	12	10
BW <sub>Channel</sub>		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift betwe	een Cells	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific referenc	e signals		A	ntenna ports 0,1	
CSI reference sig	gnals		Antenna ports 15,16	N/A	N/A
CSI-RS periodicit subframe offs $T_{CSI-RS} / \Delta_{CSI-R}$	et	Subframes	5 / 4	N/A	N/A
CSI reference si configuratior	gnal		8	N/A	N/A
Zero-power CSI configuratior I <sub>CSI-RS</sub> / ZeroPowe bitmap	-RS	Subframes / bitmap	[4 / 0010000000000 00]	N/A	N/A
ABS pattern (No	te 5)		N/A	0000000001 00000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (			000000001 0000000001	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
(Note7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control OFDM symbols			2	Note 8	Note 8
PDSCH transmissio	n mode		TM9-1layer	Note 9	Note 9
Precoding granularity			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming me			Annex B.4.1	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

### Table 8.3.2.1.C-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

-		
ſ	Note 1:	$P_B = 1$ .
	Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a
		subframe overlapping with the aggressor ABS.
	Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
	Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
	Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the
		definition of the reference channel.
	Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
	Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
	Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
	Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
	Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
	Note 11:	For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.
	Note 12:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
	Note 13:	
	Note 14:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

#### Table 8.3.2.1.C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Test Number	Reference Channel	00	NG Patt	ern	Propagation Conditions (Note1)		Correlation Reference Value Matrix and			UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.51 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD		EVA5		2x2 Low	70	8.5	≥2
Note 1: Note 2: Note 3:	The correlation	on matrix	and the $\hat{E}_s/N_{oc2}$ of cell 1.								

### 8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

Parame	ter	Unit	Test 1	Test 2			
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0			
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)			
allocation	σ	dB	-3	-3			
Cell-spec referenc symbol	ce		Antenna port 0 ai 1	nd antenna port			
Beamforn model			Annex	B.4.2			
$N_{_{oc}}$ at ant port	enna	dBm/15kHz	-98	-98			
Symbols unused P			OCNG (Note 2)	OCNG (Note 2)			
Number allocate resource b	ed	PRB	50	50			
PDSCH transmission mode			8	8			
Note 1:	$P_{R} = 1$						
Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseud random data, which is QPSK modulated.							

#### Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG Propagat		Correlation	Reference value		UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	4.5	≥2	
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.7	≥2	

### 8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

#### Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

paramotor		Unit	Test 1				
parameter		Unit	Cell 1	Cell 2			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	4	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)	0			
	σ	dB	-3	-3			

Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1							
Cell ID		0	126							
CSI reference signals		Antenna ports 15,16	NA							
Beamforming model		Annex B.4.2	NA							
CSI-RS periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	5 / 4	NA							
CSI reference signal configuration		8	NA							
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	4 / 0010000000000000000000000000000000000	NA							
$N_{_{oc}}$ at antenna port	dBm/15kHz	-98	-98							
$\widehat{E}_s/N_{oc}$		Reference Value in Table 8.3.2.3-2	Test specific, 7.25dB							
Symbols for unused PRBs		OCNG (Note 2)	NA							
Number of allocated resource blocks (Note 2)	PRB	50	NA							
Simultaneous transmission		No	NA							
PDSCH transmission mode		9	Blanked							
mode9DiankedNote 1: $P_B = 1$ Note 2:These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.										

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel	OCNG Pattern		Propagation Condition		Correlation Matrix and	Reference	value	UE Cate
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	gory
1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	N/A	ETU5	ETU5	2x2 Low	70	[14.8]	2-8
Note 1: Note 2: Note 3:	Note 1:         The propagation conditions for Cell 1 and Cell 2 are statistically independent.           Note 2:         Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.									

# 8.3.2.4 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.2.4.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.1-3, with the additional parameters in Table 8.3.2.4.1-1 and Table 8.3.2.4.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the

'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.2.4.1-2. In Table 8.3.2.4.1-1 and 8.3.2.4.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Paramete	r	Unit	TP 1	TP 2
Development	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	(Note 2)
CSI-RS 0 anteni	na ports		NA	Port {15,16}
<i>qcI-CSI-RS-Configl</i> CSI-RS 0 period subframe offset <i>T</i> <sub>CS</sub>	icity and ₋ <sub>RS</sub> / ∆ <sub>CSI-RS</sub>	Subframes	NA	5/4
qcl-CSI-RS-Configl CSI-RS 0 config	uration		NA	8
csi-RS-ConfigZPId power CSI-RS 0 co I <sub>CSI-RS</sub> / ZeroPower CSI-R	nfiguration		NA	4/ 0000010000000000
$N_{_{oc}}$ at antenn		dBm/15kH z	-98	-98
$\widehat{E}_{s}/N_{oc}$		dB	Reference point in Table 8.3.2.4.1-3	Reference point in Table 8.3.2.4.1-3
BW <sub>Channe</sub>	l	MHz	10	10
Cyclic Pret	ïx		Normal	Normal
Cell Id			0	0
Number of contro symbols	I OFDM		2	2
PDSCH transmiss	ion mode		Blanked	10
Number of alloca	ted PRB	PRB	NA	50
<i>qcl-Operation, '</i> PE Mapping and Qu Location Indic	iasi-Co-		Туре	B, '00'
Time offset betw	een TPs	μs	NA	Reference point in Table 8.3.2.4.1-3
Frequency error be	tween TPs	Hz	NA	0
Beamforming	nodel		NA	Port 7 as specified in clause B.4.1
Symbols for unus	ed PRBs		NA	OCNG (Note 3)
Note 3: These ph	ysical resou	rce blocks are	zero transmission powe assigned to an arbitrary data transmitted over th	number of virtual UEs

Table 8.3.2.4.1-1: Test Parameters for quasi co-location type B: same Cell ID

shall be uncorrelated pseudo random data, which is QPSK modulated.

PQI set index	Parameter	s in each PQI set	DL transmission hypothesis for eac PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2	
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH	

#### Table 8.3.2.4.1-2 Configurations of PQI and DL transmission hypothesis for each PQI set

#### Table 8.3.2.4.1-3: Minimum performance for quasi co-location type B: same Cell ID

Test Number	Reference Channel		iCN tern	Time offset between	offset Conditions		Correlation Matrix and Antenna	Reference	/alue	UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 TDD	NA	OP.1 TDD	2	EPA5	EPA5	2x2 Low	70	12	≥2
2	R.52 TDD	NA	OP.1 TDD	-0.5	EPA5	EPA5	2x2 Low	70	12.4	≥2
Note 1:	The propagation	on condi	tions for	TP 1 and TF	2 are sta	atistically	independent.			
Note 2:	The correlation	n matrix	and ante	enna configu	ration app	bly for TP	1 and TP 2.			
Note 3:	SNR correspo	nds to $\hat{I}$	$\hat{E}_s / N_{oc}$	of TP 2 as d	efined in	clause 8.	1.1.			

#### 8.3.2.4.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.2.4.2-3, with the additional parameters in Table 8.3.2.4.2-1 and 8.3.2.4.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In8.3.2.4.2-1 and 8.3.2.4.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

paramete	er	Unit	TP 1	TP 2
Downlink nowor	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Beamforming mode	el		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals			Antenna ports 0,1	(Note 2)
CSI reference signa	I reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicit subframe offset T <sub>CS</sub>	$\Delta_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$	Subframes	5 / 4	N/A
CSI reference signa configuration	al O		0	N/A
CSI reference signa	als 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicit subframe offset T <sub>CS</sub>	y and $_{\text{SI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/4
CSI reference signation			N/A	8
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS	bitmap	Subframes /bitmap	4/ 0010000000000000000000000000000000000	N/A
Zero-power CSI-RS1 configuration <i>I</i> <sub>CSI-RS</sub> / <i>ZeroPower CSI-RS</i> bitmaps		Subframes /bitmap	N/A	4/ 0000010000000000
$\widehat{E}_{s}/N_{oc}$	·	dB	Reference Value in Table 8.3.2.4.2-3	Reference Value in Table 8.3.2.4.2-3
$N_{\scriptscriptstyle oc}$ at antenna por	ť	dBm/15kH z	-98	-98
BW <sub>Channel</sub>		MHz	10	10
Cyclic Prefix			Normal	Normal
Cell Id			0	0
Number of control ( symbols	DFDM		2	2
Timing offset betwe	en TPs		N/A	Reference Value in Table 8.3.2.4.2-3
Frequency offset be	etween TPs	Hz	N/A	0
Number of allocated blocks	d resource	PRB	50	50
PDSCH transmission	on mode		10	10
Probability of occur PDSCH transmission		%	30	70
Symbols for unused	· · ·		OCNG (Note 4)	OCNG (Note 4)
Note 1: $P_B = 1$ Note 2: REs for a	antenna ports	0 and 1 have	zero transmission powe	r.

#### Table 8.3.2.4.2-1: Test Parameters for timing offset compensation with DPS transmission

PDSCH transmission from TPs shall be randomly determined independently for Note 3: each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified. Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

PQI set index	Parameter	s in each PQI set	hypoth	smission esis for PQI Set
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH

#### Table 8.3.2.4.2-2 Configurations of PQI and DL transmission hypothesis for each PQI set

Table 8.3.2.4.2-3 Performance Requirements for timing offset compensation with DPS transmission
-------------------------------------------------------------------------------------------------

Test Number	Timing offset(us)	Reference Channel	OCNG Pattern				Correlation Matrix and	Reference	Value	UE Category			
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)				
1	2	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.3	≥2			
2	-0.5	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.5	≥2			
Note 1: Note 2: Note 3:	Correlation r	matrix and ant	tenna co	e 1: The propagation conditions for TP 1 and TP 2 are statistically independent. e 2: Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.									

# 8.3.2.4.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.3-2, with the additional parameters in Table 8.3.2.4.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In 8.3.2.4.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

paramete	r	Unit	TP 1	TP 2	
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	0	
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	

Beamforming model		N/A	As specified in clause B.4.2				
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1				
CSI reference signals 0		N/A	Antenna ports {15,16}				
CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$	Subframes	N/A	5 / 4				
CSI reference signal 0 configuration		N/A	0				
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	4/ 00100000000000000				
$\widehat{E}_s/N_{oc}$	dB	Reference point in Table 8.3.2.4.3-2 + 4dB	Reference Value in Table 8.3.2.4.3-2				
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98				
BW <sub>Channel</sub>	MHz	10	10				
Cyclic Prefix		Normal	Normal				
Cell Id		0	126				
Number of control OFDM symbols		1	2				
Timing offset between TPs	us	N/A	0				
Frequency offset between TPs	Hz	N/A	200				
<i>qcl-Operation, '</i> PDSCH RE Mapping and Quasi-Co- Location Indicator'		Туре В, '00'					
PDSCH transmission mode		Blank	10				
Number of allocated resource block		N/A	50				
Symbols for unused PRBs		N/A	OCNG(Note2)				
Note 1: $P_B = 1$ Note 2:These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.							

 Table 8.3.2.4.3-2 Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note1)		Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 TDD	N/A	OP.1 TDD	EPA5	ETU5	2x2 Low	70	14.7	≥2
Note 1: Note 2: Note 3:	The propagation conditions for TP 1 and TP 2 are statistically independent. Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2. SNR corresponds to $\hat{E}_s/N_{oc}$ of TP 2 as defined in clause 8.1.1.								

# 8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH

# 8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

Parameter		Unit	Single antenna port	Transmit diversity
Number of PDC	CH symbols	symbols	2	2
PHICH Ng (	Note 1)		1	1
PHICH du	ration		Normal	Normal
Unused RE-s a	and PRB-s		OCNG	OCNG
Cell II	D		0	0
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
$N_{\scriptscriptstyle oc}$ at antenna port		dBm/15kHz	-98	-98
Cyclic pi	refix		Normal	Normal
Note 1: Accordin	ng to Clause 6.9	in TS 36.211 [4].		

#### Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

### 8.4.1.1 Single-antenna port performance

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and correlation	Reference Pm-dsg (%)	ce value SNR (dB)
						Matrix		
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x2 Low	1	-1.7

## 8.4.1.2 Transmit diversity performance

#### 8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Reference Pm-dsq (%)	e value SNR (dB)
						and correlation Matrix		
						IVIALITA		
1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 2 Low	1	-0.6

#### Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

#### 8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	ce value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 2 Medium	1	6.3

#### Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

# 8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Paramete	r	Unit	Cell 1	Cell 2	
	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	
	N <sub>oc1</sub>	dBm/15kHz	-100.5 (Note 1)	N/A	
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A	
	N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A	
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.4.1.2.3- 2	1.5	
BW <sub>Channel</sub>		MHz	10	10	
Subframe Config	uration		Non-MBSFN	Non-MBSFN	
Time Offset betwe	en Cells	μs	2.5 (synchro	nous cells)	
Cell Id			0	1	
ABS pattern (N	ote 4)		N/A	00000100 00000100 00000100 01000100 00000100	
RLM/RRM Measurement Subframe Pattern (Note 5)			00000100 00000100 00000100 00000100 00000100	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		00000100 00000100 00000100 01000100 00000100	N/A	
(Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 11111011 10111011 11111011	N/A	
Number of control OF			3	3	
PHICH Ng (No			1 Extended	N/A	
PHICH durat Unused RE-s and			Extended OCNG	N/A OCNG	
Cvclic pref			Normal	Normal	
Note 1: This noise is a overlapping wi	oplied in OFDM s th the aggressor oplied in OFDM s	L symbols #1, #2, #3, #5, ABS. symbols #0, #4, #7, #11	#6, #8, #9, #10, #12,	#13 of a subframe	
Note 3: This noise is a Note 4: ABS pattern as	pplied in all OFDI defined in [9]. P I in the serving ce	M symbols of a subfram DCCH/PCFICH other the sell subframe when the	nan that associated wi	th SIB1/Paging	
Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];					
measurements	defined in [7];	ime-domain measurem			
and Cell2 is the	e same.	is the aggressor cell. Th	ne number of the CRS	ports in Cell1	
	e transmitted in ( lause 6.9 in TS 3				

Table 0.4.4.0.0.4. Tast Barriestons for DDOOL/DOFICIL New MDOEN ADO	
Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS	

Test Numb er	Aggregati on Level	Referen ce Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna		rence lue
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-3.9
Note 1:		The propagation conditions for Cell 1 and Cell 2 are statistically independent.							
Note 2:	SNR corresponds to $\widehat{E}_s/N_{oc2}$ of cell 1.								
Note 3:	The correlat	ion matrix ar	nd antenn	a configu	iration ap	ply for Ce	ell 1 and Cell 2.		

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Paramet	er	Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N <sub>oc1</sub>	dBm/15kHz	-100.5 (Note 1)	N/A
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A
	N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A
$\widehat{E}_{s}/N_{ot}$	-2	dB	Reference Value in Table 8.4.1.2.3- 4	1.5
BW <sub>Chann</sub>	el	MHz	10	10
Subframe Conf	iguration		Non-MBSFN	MBSFN
Time Offset betw	veen Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	126
ABS pattern (	Note 4)		N/A	0001000000 0100000010 0000001000 0000000
RLM/RRM Measuren Pattern (No			0001000000 010000010 0000001000 00000000	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0001000000 010000010 0000001000 00000000	N/A
(Note 6)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111111	N/A
MBSFN Subframe Allo	ocation (Note 9)		N/A	001000 100001 000100 000000
Number of control OFDM symbols			3	3
PHICH Ng (N			1	N/A
PHICH dur			extended	N/A
Unused RE-s a			OCNG	OCNG
Cyclic pre	etix		Normal	Normal

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. The 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> subframes indicated by ABS pattern
	are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is
	overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in
	the definition of the reference channel.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7].
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 7:	Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1
	and Cell2 is the same.
Note 8:	SIB-1 will not be transmitted in Cell2 in this test.
Note 9:	MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN
	subframe allocation.
Note 10:	
	transmission is in a subframe protected by MBSFN ABS in this test.
Note 11:	According to Clause 6.9 in TS 36.211 [4].

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH – MBSFN ABS

Test Numb er	Aggregati on Level	Reference Channel		OCNG Pattern		attern C		gation itions te 1)	Correlation Matrix and Antenna	Refere	nce Value
			Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Pm- dsg (%)	SNR (dB) (Note 2)		
1	8 CCE	R15-1 FDD	OP.1 FDD						-4.2		
Note 1:		The propagation conditions for Cell 1 and Cell2 are statistically independent.									
Note 2:	SNR corresponds to $\widehat{E}_s/N_{oc2}$ of cell 1.										
Note 3:	The correlat	ion matrix and	antenna	configura	tion appl	y for Cell	1 and Cell 2.				

# 8.4.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-4.

In Tables 8.4.1.2.4-1 and 8.4.1.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98(Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\hat{E}_s/N$		dB	Reference Value in Table 8.4.1.2.4-2	5	3
BW <sub>Ch</sub>	annel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS patterr	n (Note 4)		N/A	00000100 00000100 00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100
RLM/RRM Me Subframe Patt			00000100 00000100 00000100 00000100 00000100	N/A	N/A
CSI Subframe	CSI Subframe		00000100 00000100 00000100 00000100 00000100	N/A	N/A
Sets (Note 6)			11111011 11111011 11111011 11111011 11111011 11111011	N/A	N/A
Number of control OFDM symbols			2	Note 7	Note 7
PHICH Ng			1	N/A	N/A
PHICH d	uration		Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic	Dielix		Normal	Normal	Normal

Table 8.4.1.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.
Note 9:	SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.
Note 10:	According to Clause 6.9 in TS 36.211 [4].

# Table 8.4.1.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG Pattern Propagation Conditions (Not				Reference Value				
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.2
Note 1: Note 2: Note 3:	Note 1:The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.Note 2:The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										

Paran	neter	Unit	Cell 1	Cell 2	Cell 3	
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3	
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3	
	N <sub>oc1</sub>	dBm/15kHz	-98(Note 1)	N/A	N/A	
$N_{oc}$ at antenna	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A	
port	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 3)	N/A	N/A	
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.4.1.2.4-4	5	3	
BW <sub>Cr</sub>	nannel	MHz	10	10	10	
Subframe Co	onfiguration		Non-MBSFN	MBSFN	MBSFN	
Time Offset between Cells		μs	N/A	3	-1	
Frequency shift between Cells		Hz	N/A	300	-100	
Cell	Cell Id		0	126	1	
ABS patter	n (Note 4)		N/A	0001000000 010000010 0000001000 00000000	0001000000 010000010 0000001000 00000000	
RLM/RRM Measu Pattern (			0001000000 010000010 000001000 00000000	N/A	N/A	
CSI Subframe	C <sub>CSI,0</sub>		0001000000 010000010 000001000 00000000	N/A	N/A	
Sets (Note 6)	C <sub>CSI,1</sub>		1110111111 1011111101 1111110111 1111111	N/A	N/A	
MBSFN Subframe Allocation (Note 7)			N/A	001000 100001 000100 000000	001000 100001 000100 000000	
Number of control			2	Note 8	Note 8	
PHICH Ng			1	N/A	N/A	
PHICH o Unused RE-s			Normal OCNG	N/A OCNG	N/A OCNG	
Cyclic			Normal	Normal	Normal	

Table 8.4.1.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. The 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> subframes indicated by ABS pattern
NOLE 4.	
	are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped
	with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition
	of the reference channel.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7].
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 7:	MBSFN Subframe Allocation as defined in [7], four frames with 24 bits are chosen for MBSFN
	subframe allocation.
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
11010 0.	indicated by "0" of ABS pattern.
Note 9:	The maximum number of uplink HARQ transmission is $\leq 2$ so that each PHICH channel
Note 3.	·
No. 40.	transmission is in a subframe protected by MBSFN ABS in this test.
	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 11:	
Note 12:	According to Clause 6.9 in TS 36.211 [4].

Table 8.4.1.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG Pattern Propagation Conditions (Note				Correlation Matrix and	Referer	nce Value		
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.0
Note 2:	<ol> <li>The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.</li> <li>The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.</li> </ol>										

# 8.4.2 TDD

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

Parame	ter	Unit	Single antenna port	Transmit diversity	
Uplink downlink o (Note	•		0	0	
Special subframe (Note 2	configuration		4	4	
Number of PDC	CH symbols	symbols	2	2	
PHICH Ng (	Note 3)		1	1	
PHICH du	ration		Normal	Normal	
Unused RE-s a	and PRB-s		OCNG	OCNG	
Cell II	)		0	0	
Downlink nowor	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3	
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3	
$N_{oc}$ at anter	nna port	dBm/15kHz	-98	-98	
Cyclic pr	efix		Normal	Normal	
ACK/NACK feed	lback mode		Multiplexing	Multiplexing	
Note 1:as specified in Table 4.2-2 in TS 36.211 [4].Note 2:as specified in Table 4.2-1 in TS 36.211 [4].Note 3:According to Clause 6.9 in TS 36.211 [4].					

#### Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

## 8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referen		
number		level	Channel	Pattern	Condition	configuration and	Pm-dsg (%)	SNR (dB)	
						correlation			
						Matrix			
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x2 Low	1	-1.6	

## 8.4.2.2 Transmit diversity performance

### 8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		level	Channel	Pattern	Condition	configuration	Pm-dsg (%)	SNR (dB)
						and		
						correlation		
						Matrix		
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 2 Low	1	0.1

#### 8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference valu	
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 2 Medium	1	6.5

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

# 8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Paramet	er	Unit	Cell 1	Cell 2		
Uplink downlink co		•••••	1	1		
Special subframe of			4	4		
	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3		
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3		
	N <sub>oc1</sub>	dBm/15kHz	-100.5 (Note 1)	N/A		
$N_{oc}$ at antenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A		
	N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A		
$\widehat{E}_s/N_{oc}$	2	dB	Reference Value in Table 8.4.2.2.3-2	1.5		
BW <sub>Chann</sub>	el	MHz	10	10		
Subframe Conf	iguration		Non-MBSFN	Non-MBSFN		
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)		
Cell Id			0	1		
ABS pattern (	Note 4)		N/A	0000010001 0000000001		
RLM/RRM Measuren Pattern(No			0000000001 0000000001	N/A		
CSI Subframe	C <sub>CSI,0</sub>		0000010001 0000000001	N/A		
Sets(Note 6)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A		
Number of control O	FDM symbols		3	3		
ACK/NACK feed			Multiplexing	N/A		
PHICH Ng (N			1	N/A		
PHICH dura			extended	N/A		
Unused RE-s ar			OCNG	OCNG		
Cyclic pre			Normal	Normal		
overlapping w Note 2: This noise is aggressor AB Note 3: This noise is Note 4: ABS pattern a	<ul> <li>te 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>te 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>te 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS</li> </ul>					
Note 5: Time-domain [7].	measurement res	ource restriction pattern				
measurement	ts defined in [7].	ime-domain measureme		-		
and Cell2 is t	ne same.	is the aggressor cell. The	e number of the CRS	ports in Cell1		
	be transmitted in ( Clause 6.9 in TS 3					

### Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

Test Numbe r	Aggregatio n Level	Referenc e Channel	OCNG Pattern		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value	
			Cell 1	Cell 2	Cell 1	Cell 2 Configura		Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-3.9
Note 1:	The propagation				are statisti	cally indep	endent.		
Note 2:	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.								
Note 3:	The correlation	n matrix and a	ntenna co	nfiguration	apply for	Cell 1 and	Cell 2.		

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

	Paramete	er	Unit	Cell 1	Cell 2		
	nk downlink co			1	1		
Spec	ial subframe co			4	4		
Downl	ink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3		
	ocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3		
		$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A		
$N_{ac}$ at a	ntenna port	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A		
		N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A		
	$\widehat{E}_{s}/N_{oc2}$	2	dB	Reference Value in Table 8.4.2.2.3-4	1.5		
	BW <sub>Channe</sub>	I	MHz	10	10		
S	ubframe Config	guration		Non-MBSFN	MBSFN		
Tin	ne Offset betwe	een Cells	μS	2.5 (synchro	onous cells)		
	Cell Id			0	126		
	ABS pattern (N	lote 4)		N/A	0000000001 0000000001		
RLM/RRM Measurement Subframe Pattern(Note 5)				000000001 0000000001	N/A		
CSI S	Subframe	C <sub>CSI,0</sub>		0000000001 0000000001	N/A		
Sets	(Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A		
MBSFN	Subframe Allo	cation (Note 9)		N/A	000010		
	er of control OF			3	3		
	K/NACK feedb			Multiplexing	N/A		
	PHICH Ng (No			1	N/A		
	PHICH dura			extended	N/A		
Ur	nused RE-s an			OCNG	OCNG		
	Cyclic pref			Normal	Normal		
Note 1:       This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.         Note 2:       This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.         Note 3:       This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.         Note 3:       This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS         Note 4:       ABS pattern as defined in [9]. The 10 <sup>th</sup> and 20 <sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.							
Note 5:	[7].		ource restriction pattern				
Note 6:	measurement	s defined in [7].	time-domain measurem				
Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.							
Note 8:	SIB-1 will not	be transmitted in	Cell2 in this test.				
Note 9:	MBSFN Subfr subframe allo		s defined in [7], one fran	ne with 6 bits is chose	en for MBSFN		
Note 10:	According to (	Clause 6.9 in TS 3	36.211 [4].				

Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG	Pattern	Propag Condition		Correlation Matrix and		
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Pm-dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-4.1
Note 1:	The propagation				statistically in	ndependen	t.		
Note 2:	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.								
Note 3:	The correlation	n matrix and ar	ntenna confi	iguration ap	ply for Cell 1	and Cell 2			

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

# 8.4.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-4.

In Tables 8.4.2.2.4-1 and 8.4.2.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Param	eter	Unit	Cell 1	Cell 2	Cell 3		
Uplink downlink		Unit	1	1	1		
Special subframe			4	4	4		
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3		
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3		
	N <sub>oc1</sub>	dBm/15kHz	-98(Note 1)	N/A	N/A		
$N_{oc}$ at antenna	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A		
port	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 3)	N/A	N/A		
$\widehat{E}_s/N$		dB	Reference Value in Table 8.4.2.2.4-2	5	3		
BW <sub>Ch</sub>	annel	MHz	10	10	10		
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN		
Time Offset be	etween Cells	μs	N/A	3	-1		
Frequency shift	between Cells	Hz	N/A	300	-100		
Cell	ld		0	126	1		
ABS pattern	n (Note 4)		N/A	0000000001 0000000001	0000000001 0000000001		
RLM/RRM Me Subframe Patt			0000000001 0000000001	N/A	N/A		
CSI Subframe	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A		
Sets (Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A		
Number of co			2	Note 7	Note 7		
ACK/NACK fee	edback mode		Multiplexing	N/A	N/A		
PHICH Ng			1	N/A	N/A		
PHICH d			Normal	N/A	N/A		
Unused RE-s			OCNG	OCNG	OCNG		
Cyclic			Normal	Normal	Normal		
overlap Note 2: This no	ping with the agg	0FDM symbols #1, # ressor ABS. 0FDM symbols #0, #					
Note 3: This no Note 4: ABS pa transmi	ise is applied in a attern as defined i tted in the serving	II OFDM symbols of n [9]. PDCCH/PCFI g cell subframe whe	CH other than that	associated with S	SIB1/Paging are		
	ne of aggressor c omain measurem	ent resource restric	tion pattern for PC	ell measurements	as defined in		
Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI							
Note 7: The nu	ements defined in mber of control O ed by "0" of ABS p	FDM symbols is not	available for ABS	and is 2 for the s	ubframe		
Note 8: The nu Note 9: SIB-1 v	mber of the CRS	ports in Cell1, Cell2 tted in Cell2 and Ce		ame.			

Table 8.4.2.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	Channel Conditions (Note 1)	OCNG Pattern									Reference Value	
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)			
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.0			
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_s/N_{ac2}$ of cell 1.													

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink			1	1	1			
Special subframe			4	4	4			
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3			
allocation			-3	-3	-3			
	$N_{oc1}$	dBm/15kHz	-98(Note 1)	N/A	N/A			
N <sub>oc</sub> at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A			
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A			
$\widehat{E}_s/N$		dB	Reference Value in Table 8.4.2.2.4-4	5	3			
BW <sub>Ch</sub>	annel	MHz	10	10	10			
Subframe Co	onfiguration		Non-MBSFN	MBSFN	MBSFN			
Time Offset be	etween Cells	μs	N/A	3	-1			
Frequency shift	between Cells	Hz	N/A	300	-100			
Cell	ld		0	126	1			
ABS patterr	. ,		N/A	0000000001 0000000001	0000000001 0000000001			
RLM/RRM Me Subframe Patt			0000000001 0000000001	N/A	N/A			
CSI Subframe	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A			
Sets (Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A			
MBSFN Subfrat (Note			N/A	000010	000010			
Number of control	OFDM symbols		2	Note 8	Note 8			
ACK/NACK fee	edback mode		Multiplexing	N/A	N/A			
PHICH Ng	(Note 11)		1	N/A	N/A			
PHICH d	uration		Normal	N/A	N/A			
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG			
Cyclic p	orefix		Normal	Normal	Normal			
Note 1:         This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.           Note 2:         This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.           Note 3:         This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS           Note 4:         ABS pattern as defined in [9]. The 10 <sup>th</sup> and 20 <sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.								
[7].		ent resource restricti						
measur Note 7: MBSFN								
Note 8: The nur		DM symbols is not	available for ABS a	and is 2 for the su	ubframe			
Note 9: Cell 1 is Cell2 is	the same.	Cell 2 is the aggress		er of the CRS por	rts in Cell1 and			
	ill not be transmitt ng to Clause 6.9 i	ted in Cell2 in this te n TS 36.211 [4].	est.					

Table 8.4.2.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG Pattern			Propagation Correlation Conditions (Note 1) Matrix and		Refere	nce Value		
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-1.8
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_{s}/N_{ac2}$ of cell 1.								•		

Table 8.4.2.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

# 8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

# 8.5.1 FDD

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

Param	eter	Unit	Single antenna port	Transmit diversity			
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3			
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3			
PHICH du	uration		Normal	Normal			
PHICH Ng	(Note 1)		Ng = 1	Ng = 1			
PDCCH C	Content			be included with the n aligned with A.3.6.			
Unused RE-s	and PRB-s		OCNG	OCNG			
Cell	Cell ID		0	0			
$N_{\scriptscriptstyle oc}$ at antenna port		dBm/15kHz	-98	-98			
Cyclic p	orefix		Normal	Normal			
Note 1: according to Clause 6.9 in TS 36.211 [4]							

Table 8.5.1-1: Test Parameters for PHICH

## 8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Reference value	
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 2 Low	0.1	5.5
2	10 MHz	R.24	OP.1 FDD	ETU70	1 x 2 Low	0.1	0.6

# 8.5.1.2 Transmit diversity performance

# 8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.1-1: M	inimum performance PHICH
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Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 2 Low	0.1	4.4

## 8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 2 Medium	0.1	6.1

# 8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Paramete		Unit	Cell 1	Cell 2
Downlink power allocation	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
$N_{oc}$ at antenna port	N <sub>oc1</sub>	dBm/15kHz	-100.5 (Note 1)	N/A
	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A
	N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A
$\widehat{E}_s/N_{oct}$		dB	Reference Value in Table 8.5.1.2.3- 2	1.5
BW <sub>Channe</sub>	91	MHz	10	10
Subframe Confi	guration		Non-MBSFN	Non-MBSFN
Time Offset betw	een Cells	μs	2.5 (synchron	ious cells)
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets (Note 6)	C <sub>CSI,0</sub>		00000100 00000100 00000100 01000100 00000100	N/A
	C <sub>CSI,1</sub>		11111011 11111011 11111011 10111011 10111011 11111011	N/A
Number of control OF			3	3
PHICH Ng (N	,		1	N/A
PHICH dura Unused RE-s an			extended OCNG	N/A OCNG
Cyclic pre			Normal	Normal
Note 1:This noise is a overlapping wNote 2:This noise is a aggressor ABNote 3:This noise is a ABS pattern a	pplied in OFDM s ith the aggressor / pplied in OFDM s S pplied in OFDM s s defined in [9]. Pl	ymbols #1, #2, #3, #5, # ABS ymbols #0, #4, #7, #11 o ymbols of a subframe ov HICH is transmitted in th ABS subframe of aggre	6, #8, #9, #10,#12, #1 of a subframe overlapp verlapping with aggres le serving cell subfram	3 of a subframe bing with the sor non-ABS e when the
indicated by th Note 5: Time-domain [7]	ne ABS pattern. measurement reso	ource restriction pattern	for PCell measuremen	ts as defined in
measurement	s defined in [7]	ime-domain measureme		-
Cell2 is the sa Note 8: SIB-1 will not	•		e number of the CRS p	oorts in Cell1 and

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Antenna Configuration and	Refere	nce Value		
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)		
1	R.19	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	0.1	4.6		
Note 1:					ell 2 are s	tatistically indepen	dent.	•		
Note 2:	SNR correspor	corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.								
Note 3:	The correlation	matrix ar	nd antenna	a configura	ation appl	y for Cell 1 and Ce	ll 2.			

Table 8.5.1.2.3-2: Minimum performance PHICH

# 8.5.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.4-2. In Table 8.5.1.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

$ \frac{P \text{PDCCH RA} \\ P \text{PDCCH RB} \\ P \text{PCFI-RB P \text{PCFI-RB P \text{PICH RB} \\ P \text{PCR-RB RD R-S} \\ OCNG RA \\ P \text{PCR-RB P \text{PICH RB} \\ P \text{PICH RB P \text{PICH RB} } \\ P \text{PICH RB P \text{PICH RB} \\ OCNG RA \\ 0 \text{CNG RB } \\ P \text{PICH RB P \text{PICH RB} P \text{PICH RB P \text{PICH RB} } \\ OCNG RA \\ OCNG RA \\ 0 \text{CNG RB } \\ P \text{PICH RB P \text{PICH RB} } \\ OCNG RA \\ OCNG RB \\ OCNG \\ O$	Param	eter	Unit	Cell 1	Cell 2	Cell 3
$ \frac{\text{allocation}}{\text{PDCH-RB}} \frac{\text{PCFOR-RB}}{\text{PHCH_RB}} dB \\ dB \\ -3 \\ -3 \\ -3 \\ -3 \\ -3 \\ -3 \\ -3 \\ -$	Downlink power	PHICH_RA	dB	-3	-3	-3
$ \frac{N_{oc}}{Port} = \frac{N_{oc2}}{N_{oc3}} = \frac{dBm/15kHz}{dBm/15kHz} = \frac{-98 (Note 2)}{-93 (Note 3)} = \frac{N/A}{N/A} =$		PDCCH_RB PHICH_RB	CCH_RA HICH_RA CNG_RAdBHICH_RB CCH_RB 	-3	-3	-3
$\frac{N_{ac2}}{N_{ac3}}  \frac{N_{ac2}}{dBm/15kHz}  \frac{90}{90} (kde 2) = N/A \qquad N/A \\ N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{\bar{k}_s/N_{ac2}}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{93}{90} (kde 2) = N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  dBm/15kHz \qquad \frac{100}{10}  10 \\ \frac{\bar{k}_s/N_{ac2}}{2}  MHz \qquad N/A \qquad 3 \\ \frac{100}{100}  -100 \\ \frac{\bar{k}_s/N_{ac2}}{2}  Non-MBSFN \qquad Non-MBSFN \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad 300  -100 \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \qquad N/A \qquad N/A \\ \frac{\bar{k}_s/N_{ac2}}{2}  N/A \qquad N/A \qquad N/A \qquad N/$		N <sub>oc1</sub>	dBm/15kHz	-98 (Note 1)	N/A	N/A
$\frac{ N_{oc3} }{ R_{c} /N_{oc2} } = \frac{ N_{oc3} }{ A_{c} } = \frac{ A_{c} }{ A_{c} } =  A_{c$		N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
Subframe Configuration         Non-MBSFN         Non-MBSFN         Non-MBSFN           Time Offset between Cells         μs         N/A         3         -1           Frequency shift between Cells         Hz         N/A         300         -100           Cell Id         0         126         1           PDCCH Content         UL Grant should be included with the proper information aligned with A.3.6.         N/A         N/A         N/A           ABS pattern (Note 4)         N/A         00000100 00000100 00000100 00000100         00000100 00000100 00000100 00000100         00000100 00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         C <sub>CSI.0</sub> 00000100 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI.0</sub> 111111011 L         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI.1</sub> 11111011 L         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           NHICH duration         Normal         N/A         N/A           PHICH duration         Normal         N/A         N/A	$\widehat{E}_s/N$		dB	in Table 8.5.1.2.4-	5	3
Time Offset between Cells         μs         N/A         3         -1           Frequency shift between Cells         Hz         N/A         300         -100           Cell Id         0         126         1           PDCCH Content         UL Grant should be included with A.3.6.         N/A         N/A         N/A           ABS pattern (Note 4)         N/A         N/A         00000100 00000100 00000100 00000100         00000100 00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         C <sub>CSI,0</sub> 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,1</sub> 11111011 11111011         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH duration         Normal         N/A         N/A           VMmber of control OFDM symbols         2         Note 7         Note 7	BW <sub>Ch</sub>	annel	MHz	10	10	10
Frequency shift between Cells         Hz         N/A         300         -100           Cell Id         0         126         1           PDCCH Content         UL Grant should be included with the proper information aligned with A.3.6.         N/A         N/A         N/A           ABS pattern (Note 4)         N/A         N/A         00000100 00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         C <sub>CSI,0</sub> 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 11111011 111111011         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH Ng (Note 10)         1         N/A         N/A           Unused RE-s and PRB-s         OCNG         OCNG         OCNG	Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id         0         126         1           PDCCH Content         UL Grant should be included with the proper information aligned with A.3.6.         N/A         N/A           ABS pattern (Note 4)         N/A         00000100 00000100 00000100 00000100 00000100 00000100         00000100 00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100         N/A         N/A           CCSI Subframe Sets (Note 6)         CCSI.0         00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         CCSI.1         011111011 11111011         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH duration         1         N/A         N/A           Unused RE-s and PRB-s         OCNG         OCNG         OCNG	Time Offset be	etween Cells	μs	N/A	3	-1
PDCCH Content         UL Grant should be included with the proper information aligned with A.3.6.         N/A         N/A           ABS pattern (Note 4)         N/A         00000100 00000100 00000100 00000100 00000100 00000100         00000100 00000100 00000100 00000100         00000100 00000100 00000100         00000100 00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         11111011 C <sub>CSI,1</sub> N/A         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH duration         1         N/A         N/A           Unused RE-s and PRB-s         OCNG         OCNG         OCNG	Frequency shift	between Cells	Hz	N/A	300	-100
$ \begin{array}{c c c c c c } \mbox{PDCCH Content} & be included with the proper information aligned with the proper information aligned with A.3.6. N/A N/A \\ \mbox{ABS pattern (Note 4)} & & & & & & & & & & & & & & & & & & &$	Cell	ld		0	126	1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	PDCCH (	Content		be included with the proper information aligned with	N/A	N/A
RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,1</sub> 00000100 00000100         N/A         N/A           Number of control OFDM symbols         2         Note 7         N/A           Number of control OFDM symbols         2         Note 7         N/A           Number of control OFDM symbols         2         N/A         N/A           VA         N/A         N/A         N/A           NUMBER of Control OFDM symbols         2         Note 7         Note 7           NHICH duration         Normal         N/A         N/A	ABS patterr	n (Note 4)			00000100 00000100 00000100	00000100 00000100 00000100
CSI Subframe         C <sub>CSI,0</sub> 00000100 00000100 00000100         N/A         N/A           Sets (Note 6)         11111011 C <sub>CSI,1</sub> 11111011 11111011         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH Ng (Note 10)         1         N/A         N/A           Unused RE-s and PRB-s         OCNG         OCNG         OCNG				00000100 00000100 00000100		
C_{CSI,1}11111011 11111011 11111011 11111011N/AN/ANumber of control OFDM symbols2Note 7Number of control OFDM symbols2Note 7PHICH Ng (Note 10)1N/APHICH durationNormalN/AUnused RE-s and PRB-sOCNGOCNG		C <sub>CSI,0</sub>		00000100 00000100 00000100 00000100	N/A	N/A
Number of control OFDM symbols2Note 7Note 7PHICH Ng (Note 10)1N/AN/APHICH durationNormalN/AN/AUnused RE-s and PRB-sOCNGOCNGOCNG	Sets (Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 11111011 11111011	N/A	N/A
PHICH duration         Normal         N/A         N/A           Unused RE-s and PRB-s         OCNG         OCNG         OCNG						
Unused RE-s and PRB-s OCNG OCNG OCNG				•		
Cyclic prefix Normal Normal Normal						

Table 8.5.1.2.4-1: Test Parameters for PHICH
----------------------------------------------

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 3:	This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26 <sup>th</sup> subframe indicated by the ABS pattern.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 9:	SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.
Note 10:	According to Clause 6.9 in TS 36.211 [4].

# Table 8.5.1.2.4-2: Minimum performance PHICH

Test Number	Reference Channel	00	NG Patt	ern	Propagation Conditions (Note 1)		Antenna Configuration	Refere	ence Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.0
Note 1: Note 2: Note 3:	The propagation The correlation SNR correspond	matrix an	d antenn	a configu					·	

# 8.5.2 TDD

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

Param	eter	Unit	Single antenna port	Transmit diversity
Uplink downlink cor 1)	plink downlink configuration (Note 1)		1	1
Special subframe (Note	•		4	4
	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
PHICH du	uration		Normal	Normal
PHICH Ng	(Note 3)		Ng = 1	Ng = 1
PDCCH C	Content			I be included with the on aligned with A.3.6.
Unused RE-s	and PRB-s		OCNG	OCNG
Cell	D		0	0
$N_{\scriptscriptstyle oc}$ at ante	enna port	dBm/15kHz	-98	-98
	Cyclic prefix		Normal	Normal
ACK/NACK fee			Multiplexing	Multiplexing
	ied in Table 4.2-2			
	ied in Table 4.2-1		.]	
Note 3: accordin	g to Clause 6.9 in	18 36.211 [4]		

#### Table 8.5.2-1: Test Parameters for PHICH

### 8.5.2.1 Single-antenna port performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Reference value		
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)	
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 2 Low	0.1	5.8	
2	10 MHz	R.24	OP.1 TDD	ETU70	1 x 2 Low	0.1	1.3	

#### Table 8.5.2.1-1: Minimum performance PHICH

## 8.5.2.2 Transmit diversity performance

## 8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	e OCNG Propagation Antenna		Referen	ce value	
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 2 Low	0.1	4.2

#### Table 8.5.2.2.1-1: Minimum performance PHICH

#### 8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

	Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
1	number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
	1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 2 Medium	0.1	6.2

#### Table 8.5.2.2.2-1: Minimum performance PHICH

# 8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Parameter			Unit	Cell 1	Cell 2		
Upli	nk downlink cor	nfiguration		1	1		
	cial subframe co			4	4		
Down	link power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3		
	ocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3		
		$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A		
$N_{oc}$ at a	antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A		
		N <sub>oc3</sub>	dBm/15kHz	-95.3 (Note 3)	N/A		
	$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.5.2.2.3-2	1.5		
	BW <sub>Channel</sub>		MHz	10	10		
S	Subframe Config	juration		Non-MBSFN	Non-MBSFN		
Tir	me Offset betwe	en Cells	μs	2.5 (synchronous cells)			
	Cell Id			0	1		
	ABS pattern (N	ote 4)		N/A	0000010001 0000000001		
RLM/R	RM Measurem Pattern (Note			000000001 0000000001	N/A		
CSI Sul	bframe Sets	C <sub>CSI,0</sub>		0000010001 0000000001	N/A		
	lote 6)	C <sub>CSI,1</sub>		1100101000 1100111000	N/A		
Numb	er of control OF	DM symbols		3	3		
	K/NACK feedba			Multiplexing	N/A		
	PHICH Ng (No	ote 9)		1	N/A		
	PHICH dura			extended	N/A		
U	nused RE-s and	d PRB-s		OCNG	OCNG		
	Cyclic pref			Normal	Normal		
Note 1: Note 2:	Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS						
Note 3: Note 4:							
Note 5:	Time-domain ı [7]	measurement res	ource restriction pattern	n for PCell measuremer	nts as defined in		
Note 6:	As configured	according to the the to the to the to the to a section of the total section of to	time-domain measurem	nent resource restriction	pattern for CSI		
Note 7:	Cell 1 is the se Cell2 is the sa	erving cell. Čell 2 me.		he number of the CRS p	ports in Cell1 and		
Note 8: Note 9:	Note 8: SIB-1 will not be transmitted in Cell2 in the test.						

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)		Antenna Configuration and	Reference Value	
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)
1	R.19	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	0.1	4.6
Note 1:	The propagation conditions for Cell 1 and Cell 2 are statistically independent.							
Note 2:	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1.							
Note 3:	The correlation	matrix ar	nd antenna	a configura	ation appl	y for Cell 1 and Ce	ll 2.	

Table 8.5.2.2.3-2: Minimum performance PHICH

# 8.5.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.4-2. In Table 8.5.2.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Paran		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink			1	1	1
Special subfram			4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	$N_{oc1}$	dBm/15kHz	-98 (Note 1)	N/A	N/A
$N_{oc}$ at antenna	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	$N_{oc3}$	dBm/15kHz	-93 (Note 3)	N/A	N/A
$\widehat{E}_s/N$		dB	Reference Value in Table 8.5.2.2.4-2	5	3
BW <sub>Cr</sub>	nannel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non- MBSFN
Time Offset b	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
PDCCH	Content		UL Grant should be included with the proper information aligned with A.3.6.	N/A	N/A
ABS patter	n (Note 4)		N/A	0000000001 0000000001	000000001
RLM/RRM Measur Pattern (			0000000001 0000000001	N/A	0000000001 N/A
CSI Subframe	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of contro	OFDM symbols		2	Note 7	Note 7
ACK/NACK fee			Multiplexing	N/A	N/A
PHICH Ng	(Note 10)		1	N/A	N/A
PHICH c	luration		Normal	N/A	N/A
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG
Cyclic			Normal	Normal	Normal
overlap Note 2: This noi aggress Note 3: This noi Note 4: ABS pa	ping with the aggre se is applied in OF or ABS se is applied in OF ttern as defined in	essor ABS DM symbols #0, # DM symbols of a [9]. PHICH is tran	#2, #3, #5, #6, #8, #9 #4, #7, #11 of a subf subframe overlappir smitted in the servin me of aggressor cel	rame overlapping ng with aggressor g cell subframe w	g with the non-ABS when the
Note 5: Time-do [7]	omain measuremer	nt resource restric	measurement resou	I measurements a	as defined in
Mote 7: The nur	ements defined in nber of control OF	[7] DM symbols is not	t available for ABS a		
Note 8: The nur Note 9: SIB-1 w	d by "0" of ABS pa nber of the CRS po ill not be transmitte ng to Clause 6.9 in	orts in Cell 1, Cell ed in Cell 2 and Ce	2 and Cell 3 is the s ell 3 in the test.	ame.	

Test Number	Reference Channel	00	OCNG Pattern Propagatio Conditions (No			Antenna Configuration	Reference Value			
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 TDD	OP.1 TDD	OP.1 TDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.7
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_s/N_{oc2}$ of Cell 1.									

Table 8.5.2.2.4-2: Minimum performance PHICH

# 8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the Number of transmitted MIB PDUs (Redundancy versions for the same MIB are not counted separately).

# 8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

Parame	ter	Unit	Single antenna port	Transmit diversity		
Downlink power	Downlink power PBCH_RA		0	-3		
allocation	PBCH_RB	dB	0	-3		
$N_{\it oc}$ at anter	na port	dBm/15kHz	-98	-98		
Cyclic pr	efix		Normal	Normal		
Cell I	)		0	0		
Note 1:as specified in Table 4.2-2 in TS 36.211 [4]Note 2:as specified in Table 4.2-1 in TS 36.211 [4]						

## 8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

 Table 8.6.1.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.1

## 8.6.1.2 Transmit diversity performance

### 8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

#### Table 8.6.1.2.1-1: Minimum performance PBCH

#### 8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.6.1.2.2-1: Minimum performance PBCH

	Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and		
					correlation		
					Matrix		
ľ	1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-3.5

#### 8.6.1.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.1.2.3-1 and Table 8.6.1.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, repectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Parar	neter	Unit	Cell 1	Cell 2	Cell 3	
Downlink power OCNG_RA		dB	-3	-3	-3	
allocation	PBCH_RB OCNG_RB	dB	-3	-3	-3	
$N_{oc}$ at and	enna port	dBm/15kHz	-98	N/A	N/A	
	3	dB	Reference Value in Table 8.6.1.2.3-2	4	2	
BWc	hannel	MHz	1.4	1.4	1.4	
Time Offset b	etween Cells	μs	N/A	3	-1	
Frequency shift	between Cells	Hz	N/A	300	-100	
Cel	l ld		0	126	1	
ABS Patte	rn (Note 4)		N/A	01000000 01000000 01000000 01000000 01000000	01000000 01000000 01000000 01000000 01000000	
Unused RE-	s and PRB-s		OCNG	OCNG	OCNG	
Cyclic	prefix		Normal	Normal	Normal	
Note 1:       The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.         Note 2:       SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.         Note 3:       The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.         Note 4:       ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.						

#### Table 8.6.1.2.3-1: Test Parameters for PBCH

Test	Reference	Propagation Conditions (Note 1)		Antenna Configuration	Refe	Reference Value	
Number	Channel	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-bch (%)	SNR (dB) (Note 3)
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0
Note 1:	The propagation	on conditions for	or Cell 1, 0	Cell 2 and Cell	3 are statistically independent	t.	
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.						
Note 3:	SNR correspon	nds to $\hat{E}_s / N_o$	$_c$ of cell 1.				

# 8.6.2 TDD

Parame	ter	Unit	Single antenna port	Transmit diversity	
Uplink downlink o (Note 1			1	1	
Special subframe (Note 2	•		4	4	
Downlink power allocation	PBCH_RA PBCH_RB	dB dB	0	-3	
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98	
Cyclic pr	Cyclic prefix		Normal	Normal	
Cell ID			0	0	
Note 1:as specified in Table 4.2-2 in TS 36.211 [4].Note 2:as specified in Table 4.2-1 in TS 36.211 [4].					

#### Table 8.6.2-1: Test Parameters for PBCH

### 8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.1-1: Minimum	n performance PBCH
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Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.4

## 8.6.2.2 Transmit diversity performance

#### 8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Test number	Bandwidth	Reference Channel	Propagation Condition	Antenna configuration and correlation Matrix	Referen Pm-bch (%)	ce value SNR (dB)
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

### 8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-4.1

Table 8.6.2.2.2-1: Minimum performance PBCH

#### 8.6.2.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.2.2.3-1 and Table 8.6.2.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Parameter		Unit	Cell 1	Cell 2	Cell 3	
Downlink p	power	PBCH_RA OCNG_RA	dB	-3	-3	-3
allocati	ion	PBCH_RB OCNG_RB	dB	-3	-3	-3
No	$_{c}$ at ante	enna port	dBm/15kHz	-98	N/A	N/A
	$\frac{\widehat{E}_s}{N_{oo}}$	,	dB	Reference Value in Table 8.6.2.2.3-2	4	2
	BW <sub>Cha</sub>	annel	MHz	1.4	1.4	1.4
Time C	Time Offset between Cells		μs	N/A	3	-1
Frequen	requency shift between Cells		Hz	N/A	300	-100
	Cell	ld		0	126	1
ABS	S Patterr	n (Note 4)		N/A	0000000001 0000000001	0000000001 0000000001
Unuse	ed RE-s	and PRB-s		OCNG	OCNG	OCNG
	Cyclic p			Normal	Normal	Normal
Note 1:       The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.         Note 2:       SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.         Note 3:       The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.						
,	PDCCH with the	/PCFICH are tran	smitted in the servi	than SIB1/paging a ing cell subframe w I the subframe is av	hen the subframe	e is overlapped

### Table 8.6.2.2.3-1: Test Parameters for PBCH

Test	Reference	Propagation Conditions (Note 1)		Antenna Configuration	Refe	erence Value		
Number	Channel	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-bch (%)	SNR (dB) (Note 3)	
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0	
Note 1:	The propagation	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.						
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.							
Note 3:	SNR correspo	SNR corresponds to $\hat{E}_s / N_{oc}$ of cell 1.						

# 8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available. Test case is selected according to table 8.7-1 depending on UE capability for CA and EPDCCH.

#### Table 8.7-1: SDR test applicability

	Single carrier UE not supporting EPDCCH	CA UE not supporting EPDCCH	Single carrier UE supporting EPDCCH	CA UE supporting EPDCCH
FDD	8.7.1	8.7.1	8.7.3	8.7.1, 8.7.3
TDD	8.7.2	8.7.2	8.7.4	8.7.2, 8.7.4

# 8.7.1 FDD

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured
Propagation condition		Static propagation condition No external noise sources are applied

## Table 8.7.1-1: Common Test Parameters (FDD)

The requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Test	Bandwidth	Transmission	Antenna	enna Codebook subset		Downlink power allocation (dB)		$\hat{E}_{_{s}}$ at	Symbols for
1651	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3A	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3B, 4A	2x10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6A	2x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6B	10+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6C	10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6D	15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
Note 1:	Note 1: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.								

Table 8.7.1-2: test parameters	s for sustained downlink data rate (FDI	D)
		-,

### Table 8.7.1-3: Minimum requirement (FDD)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value				
	block received within a TTI		TB success rate [%]				
1	10296	R.31-1 FDD	95				
2	25456	R.31-2 FDD	95				
3	51024	R.31-3 FDD	95				
3A	36696 (Note 2)	R.31-3A FDD	85				
3B	25456	R.31-2 FDD	95				
3C	51024	R.31-3C FDD	85				
4	75376 (Note 3)	R.31-4 FDD	85				
4A	36696 (Note 2)	R.31-3A FDD	85				
4B	55056 (Note 5)	R.31-4B FDD	85				
6	75376 (Note 3)	R.31-4 FDD	85				
6A	75376 (Note 3)	R.31-4 FDD	85				
6B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85				
	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC					
6C	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85				
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC					
6D	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC	85				
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC					
Note 1:	For 2 layer transmissions, 2 transport blocks	are received within a TTI.					
Note 2:	35160 bits for sub-frame 5.						
Note 3:							
Note 4:							
	the number of newly transmitted DL transport		insmitted DL transport				
	blocks, and N <sub>DL_correct_rx</sub> is the number of corre	ectly received DL transport blocks.					
Note 5:	52752bits for sub-frame 5.						

CA config	Maximum supported Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
Cingle	10	1	2	3A	ЗA	-	-
Single carrier	15	-	-	3C	4B	-	-
Camer	20	-	-	3	4	6	6
	10+10	-	-	3B	4A	4A	4A
CA	10+15	-	-	3B	4A	6B	6B
with	10+20	-	-	3B	4A	6C	6C
2CCs	15+20	-	-	3B	4A	6D	6D
2003	20+20	-	-	3B or 3 (Note 4)	4A or 4 (Note 4)	6A	6A
Note 1:	Void.						
Note 2:	For non-CA UE, tes	st is selected for	or maximum su	upported bandw	/idth.		
Note 3:	Void.						
Note 4:	carrier test is selecte, i.e., Test 3 for UE category 3 and Test 4 for UE category 4. Otherwise, Test 3B applies for category 3 UE and Test 4A applies for category 4 UE.						
Note 5:	The applicability of in 8.1.2.3.	requirements f	or different CA	A configurations	and bandwidth	combination s	ets is defined

Table 8.7.1-4: Test points for sustained data rate (FRC)

## 8.7.2 TDD

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

Parameter	Unit	Value			
Special subframe configuration (Note 1)		4			
Cyclic prefix		Normal			
Cell ID		0			
Inter-TTI Distance		1			
Maximum number of HARQ transmission		4			
Redundancy version coding sequence		{0,0,1,2} for 64QAM			
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1			
Cross carrier scheduling		Not configured			
Propagation condition		Static propagation condition No external noise sources are applied			
Note 1: as specified in Table 4.2-1 in TS 36.211 [4].					

### Table 8.7.2-1: Common Test Parameters (TDD)

The requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Test	Bandwidth (MHz)	Transmission mode	Antenna configuration	Codebook subset restriction		ownlii powei locatie (dB)	r	$\hat{E}_s$ at antenna port (dBm/15kHz)	ACK/NACK feedback mode	Symbols for unused PRBs
					$o_{A}$	$ ho_{\scriptscriptstyle B}$	σ	·		
1	10	1	1 x 2	N/A	0	0	0	-85	Bundling	OP.6 TDD
2	10	3	2 x 2	10	- 3	-3	0	-85	Bundling	OP.1 TDD
3	20	3	2 x 2	10	- 3	-3	0	-85	Bundling	OP.1 TDD
ЗA	15	3	2 x 2	10	- 3	-3	0	-85	Muliplexing	OP.2 TDD
4,6	20	3	2 x 2	10	- 3	-3	0	-85	Multiplexing	OP.1 TDD
6A	2x20	3	2 x 2	10	- 3	-3	0	-85	- (Note 1)	OP.1 TDD
Note 1:	Note 1: PUCCH format 1b with channel selection is used to feedback ACK/NACK.									

Table 8.7.2-2: test parameters	for sustained downlink data rate	(TDD)
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### Table 8.7.2-3: Minimum requirement (TDD)

Test	Number of bits of a DL-SCH transport block received within a TTI for normal/special sub- frame	Measurement channel	Reference value TB success rate [%]
1	10296/0	R31-1 TDD	95
2	25456/0	R31-2 TDD	95
3	51024/0	R31-3 TDD	95
ЗA	51024/0	R31-3A TDD	85
4	75376/0 (Note 2)	R31-4 TDD	85
6	75376/0 (Note 2)	R.31-4 TDD	85
6A 75376/0 (Note 2)		R.31-4 TDD	85
Note 2: 71112	ayer transmissions, 2 transport blocks are bits for sub-frame 5.		

Note 3: The TB success rate is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks.

CA config		Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
		10	1	2	-	-	-	-
Single carrier		15	-	-	ЗA	ЗA	-	-
		20	-	-	3 4		6	6
CA with 2	2CCs	20+20		-	3 (Note 4)	4 (Note 4)	6A	6A
Note 1:       Void.         Note 2:       For non-CA UE, test is selected for maximum supported bandwidth.         Note 3:       Void.         Note 4:       If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, single carrier test is								
Note 5:	selected. The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.							

## 8.7.3 FDD (EPDCCH scheduling)

The parameters specified in Table 8.7.3-1 are valid for all FDD tests unless otherwise stated.

Parameter	Unit	Value				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Number of HARQ						
processes per	Processes	8				
component carrier						
Maximum number of		4				
HARQ transmission		4				
Redundancy version		(0.0.1.2) for 640AM				
coding sequence		{0,0,1,2} for 64QAM				
Number of OFDM						
symbols for PDCCH per	OFDM symbols	1				
component carrier	•					
Cross carrier scheduling		Not configured				
Number of EPDCCH						
sets		1				
EPDCCH transmission		La selles d				
type		Localized				
Number of PRB per		2 PRB pairs				
EPDCCH set and		10MHz BW: Resource blocks n <sub>PRB</sub> = 48, 49				
EPDCCH PRB pair		15MHz BW: Resource blocks n <sub>PRB</sub> = 70, 71				
allocation		20MHz BW: Resource blocks n <sub>PRB</sub> = 98, 99				
EPDCCH Starting		Derived from CEL (i.e. default behaviour)				
Symbol		Derived from CFI (i.e. default behaviour)				
ECCE Aggregation		2 5005-				
Level		2 ECCEs				
Number of EREGs per		4				
ECCE		4				
		EPDCCH candidate is randomly assigned				
EPDCCH scheduling		in each subframe				
EPDCCH precoder		Fixed PMI 0				
(Note 1)						
EPDCCH monitoring SF		111111111 000000000				
pattern		111111111 000000000				
Timing advance	μs	100				
-		Static propagation condition				
Propagation condition		No external noise sources are applied				
Note 1: EPDCCH precoder parameters are defined for tests with 2 x 2 antenna						
configuration						
¥						

Table 8.7.3-1: Common test	parameters (FDD)
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The requirements are specified in Table 8.7.3-3, with the addition of the parameters in Table 8.7.3-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.3-4. The TB success rate shall be sustained during at least 300 frames.

Test	Bandwidth	Transmission	Antenna Codebook subset		allocation (dB)			$\hat{E}_{_{s}}$ at	Symbols for	
1651	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
ЗA	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value				
	block received within a TTI		TB success rate [%]				
1	10296	R.31E-1 FDD	95				
2	25456	R.31E-2 FDD	95				
3	51024	R.31E-3 FDD	95				
3A	36696 (Note 2)	R.31E-3A FDD	85				
3C	51024	R.31E-3C FDD	85				
4	75376 (Note 3)	R.31E-4 FDD	85				
4B	55056 (Note 5)	R.31E-4B FDD	85				
6	75376 (Note 3)	R.31E-4 FDD	85				
Note 1:	For 2 layer transmissions, 2 transport blocks	are received within a TTI.					
Note 2:	35160 bits for sub-frame 5.						
Note 3:	71112 bits for sub-frame 5.						
Note 4:	The TB success rate is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), where N <sub>DL_newtx</sub> is						
	the number of newly transmitted DL transport blocks, N <sub>DL retx</sub> is the number of retransmitted DL transport						
	blocks, and N <sub>DL_correct_rx</sub> is the number of corre						
Note 5:	52752 bits for sub-frame 5.	· ·					

Table 8.7.3-3: M	linimum rec	quirement (FDD)
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Table 8.7.3-4:	<b>Test points</b>	for sustained	data rate	(FRC)
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CA config	Bandwidth (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7			
Cingle	10	1	2	3A	ЗA	-	-			
Single	15	-	-	3C	4B	-	-			
carrier	20	-	-	3	4	6	6			
Note 1:	Note 1: The test is selected for maximum supported bandwidth.									

## 8.7.4 TDD (EPDCCH scheduling)

The parameters specified in Table 8.7.4-1 are valid for all TDD tests unless otherwise stated.

Parameter	Unit	Value				
Special subframe		4				
configuration (Note 1)		4				
Cyclic prefix		Normal				
Cell ID		0				
Inter-TTI Distance		1				
Maximum number of HARQ transmission		4				
Redundancy version coding sequence		{0,0,1,2} for 64QAM				
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1				
Cross carrier scheduling		Not configured				
Number of EPDCCH sets		1				
EPDCCH transmission type		Localized				
Number of PRB per EPDCCH set and EPDCCH PRB pair allocation		2 PRB pairs 10MHz BW: Resource blocks $n_{PRB} = 48$ , 49 15MHz BW: Resource blocks $n_{PRB} = 70$ , 71 20MHz BW: Resource blocks $n_{PRB} = 98$ , 99				
EPDCCH Starting Symbol		Derived from CFI (i.e. default behaviour)				
ECCE Aggregation Level		2 ECCEs				
Number of EREGs per ECCE		4 for normal subframe and 8 for special subframe				
EPDCCH scheduling		EPDCCH candidate is randomly assigned in each subframe				
EPDCCH precoder (Note 2)		Fixed PMI 0				
EPDCCH monitoring SF pattern		UL-DL configuration 1: 1101111111 000000000 UL-DL configuration 5: 1100111001 000000000				
Timing advance	μs	100				
Propagation condition		Static propagation condition No external noise sources are applied				
Note 1:       As specified in Table 4.2-1 in TS 36.211 [4].         Note 2:       EPDCCH precoder parameters are defined for tests with 2 x 2 antenna configuration						

Table 8.7.4-1: Common test parameters (TI	DD)
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The requirements are specified in Table 8.7.4-3, with the addition of the parameters in Table 8.7.4-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.4-4. The TB success rate shall be sustained during at least 300 frames.

Test	Bandwidth (MHz)	Transmission mode	Antenn a configu	Codebook subset		nlink catio			$\hat{E}_{_{s}}$ at antenna port	Symbols for unused	ACK/NACK feedback
	(101712)	mode	ration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	(dBm/15kHz)	PRBs	mode
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 TDD	Bundling
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Bundling
3	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Bundling
3A	15	3	2 x 2	10	-3	-3	0	3	-85	OP.2 TDD	Multiplexing
4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Multiplexing

### Table 8.7.4-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (TDD)

### Table 8.7.4-3: Minimum requirement (TDD)

Number of bits of a DL-SCH transport block received within a TTI for normal/special sub- frame	Measurement channel	Reference value TB success rate [%]					
10296/0	R.31E-1 TDD	95					
25456/0	R.31E-2 TDD	95					
51024/0	R.31E-3 TDD	95					
51024/0	R.31E-3A TDD	85					
75376/0 (Note 2)	R.31E-4 TDD	85					
75376/0 (Note 2)	R.31E-4 TDD	85					
Note 1:       For 2 layer transmissions, 2 transport blocks are received within a TTI.         Note 2:       71112 bits for sub-frame 5.         Note 3:       The TB success rate is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> + N <sub>DL_retx</sub> ), where N <sub>DL_newtx</sub> is the number of newly transmitted DL transport blocks, N <sub>DL_retx</sub> is the number of retransmitted DL transport							
	transport block received within a TTI for normal/special sub- frame 10296/0 25456/0 51024/0 75376/0 (Note 2) 75376/0 (Note 2) aver transmissions, 2 transport blocks ar bits for sub-frame 5. 3 success rate is defined as TB success nber of newly transmitted DL transport block	transport block received within a TTI for normal/special sub- frame         10296/0       R.31E-1 TDD         25456/0       R.31E-2 TDD         51024/0       R.31E-3 TDD         51024/0       R.31E-3A TDD         75376/0 (Note 2)       R.31E-4 TDD         75376/0 (Note 2)       R.31E-4 TDD         aver transmissions, 2 transport blocks are received within a TTI.         bits for sub-frame 5.       Success rate is defined as TB success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newb</sub> )					

CA config	Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7		
Single carrier	10	1	2	-	-	-	-		
	15	-	-	ЗA	ЗA	-	-		
	20	-	-	3	4	6	6		
Note 1	The test is selected for maximum supported bandwidth.								

The test is selected for maximum supported bandwidth. Note 1:

#### Demodulation of EPDCCH 8.8

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.8.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

#### **Distributed Transmission** 8.8.1

#### 8.8.1.1 FDD

The parameters specified in Table 8.8.1.1-1 are valid for all FDD distributed EPDCCH tests unless otherwise stated.

	Parame	tor					
		Unit	Value				
	PDCCH syn	symbols	2 (Note 1)				
PHICH du			Normal				
	E-s and PRB	-S		OCNG			
Cell ID				0			
		$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink p	ower	$ ho_{\scriptscriptstyle B}$	dB	-3			
allocation		σ	dB	0			
		δ	dB	3			
$N_{\scriptscriptstyle oc}$ at ant	enna port	dBm/15 kHz	-98				
Cyclic pref	ix			Normal			
Subframe	Configuratior	า		Non-MBSFN			
Procodor I	Jpdate Gran	ularity	PRB	1			
Fiecodel (		ulanty	ms	1			
	ing Pre-Code			Annex B. 4.4			
	ic Reference			Port 0 and 1			
Number of	EPDCCH S	ets Configured		2 (Note 2)			
Number of	PRB per EP	DCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)			
EPDCCH	Subframe Mo	onitoring		NA			
PDSCH TI	N			TM3			
DCI Forma	at			2A			
<ul> <li>Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is not configured.</li> <li>Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.</li> </ul>							

 Table 8.8.1.1-1: Test Parameters for Distributed EPDCCH

For the parameters specified in Table 8.8.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.1-2: Minimum performance Distributed EPDCCH

Test	Bandwidth	dwidth Aggregatio	Reference C	OCNG	Propagation	Antenna	Referenc	e value
number		n level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.60
2	10 MHZ	16 ECCE	R.56 FDD	OP.7 FDD	EVA70	2 x 2 Low	1	-3.20

8.8.1.1.1 Void

### Table 8.8.1.1.1-1: Void

### 8.8.1.2 TDD

The parameters specified in Table 8.8.1.2-1 are valid for all TDD distributed EPDCCH tests unless otherwise stated.

	Param	otor	Unit	Value				
Number	f PDCCH sy	symbols	2 (Note 1)					
PHICH du		Symbols	Normal					
	E-s and PRE	3-9		OCNG				
Cell ID		55		0				
CONTE		2	dB	-3				
_		$ ho_{\scriptscriptstyle A}$	uБ	-3				
Downlink   allocation	oower	$ ho_{\scriptscriptstyle B}$	dB	-3				
allocation		σ	dB	0				
		δ	dB	3				
$N_{_{oc}}$ at an	tenna port	dBm/15 kHz	-98					
Cyclic pre	fix			Normal				
Subframe	Configuratio	n		Non-MBSFN				
Droodor	Update Grar	ulority	PRB	1				
Flecodel	Opuale Grai	lulanty	ms	1				
	ing Pre-Cod			Annex B. 4.4				
	fic Referenc		Port 0 and 1					
Number of	FEPDCCH S	Sets Configured		2 (Note 2)				
Number o	f PRB per El	PDCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)				
EPDCCH	Subframe M	onitoring		NA				
PDSCH T	M			TM3				
DCI Forma	at			2A				
TDD UL/D	L Configuration	tion		0				
TDD Spec	ial Subframe			1 (Note 3)				
Note 1: Note 2: Note 3:	overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.							

 Table 8.8.1.2-1: Test Parameters for Distributed EPDCCH

For the parameters specified in Table 8.8.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

 Table 8.8.1.2-2: Minimum performance Distributed EPDCCH

ſ	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference value	
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	10 MHz	4 ECCE	R.55 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.8
[	2	10 MHZ	16 ECCE	R.56 TDD	OP.7 TDD	EVA70	2 x 2 Low	1	-3.10

8.8.1.2.1 Void

### Table 8.8.1.2.1-1: Void

## 8.8.2 Localized Transmission with TM9

### 8.8.2.1 FDD

The parameters specified in Table 8.8.2.1-1 are valid for all FDD TM9 localized ePDCCH tests unless otherwise stated.

Param	neter	Unit	Value					
Number of PDCCH sy	/mbols	symbols	1 (Note 1)					
EPDCCH starting syn		symbols	2 (Note 1)					
PHICH duration			Normal					
Unused RE-s and PR	B-s		OCNG					
Cell ID	-		0					
	$ ho_{\scriptscriptstyle A}$	dB	0					
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0					
allocation	σ	dB	-3					
	δ	dB	0					
$N_{\scriptscriptstyle oc}$ at antenna port		dBm/15 kHz	-98					
Cyclic prefix			Normal					
Subframe Configurati	on		Non-MBSFN					
Dragodor Undete Cro	nulority (	PRB	1					
Precoder Update Gra	nulanty	ms	1					
Beamforming Pre-Co			Annex B.4.5					
Cell Specific Reference			Port 0 and 1					
CSI-RS Reference Si			Port 15 and 16					
CSI-RS reference sig	nal resource		0					
configuration			0					
CSI reference signal	subframe		2					
configuration I <sub>CSI-RS</sub>								
ZP-CSI-RS configura	tion bitmap		00000100000000					
ZP-CSI-RS subframe	configuration I <sub>ZP</sub> .		2					
CSI-RS Number of EPDCCH	Sate		2 (Note 2)					
EPDCCH Subframe N								
subframePatternCont			1111110111 (Note 3)					
PDSCH TM	ig i i i		ТМ9					
	a symbol for EPDC	CH is signalle	d with epdcch-StartSymbol-r11. However, CFI is					
set to 1.								
	et is distributed trans	mission with	PRB = {0, 49} and the second set is localized					
			5, 42, 49}. ePDCCH is scheduled in the second set					
for all tests.								
Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific								
space only	in SFs configured b	y subframeP	atternConfig-r11. Legacy PDCCH is not scheduled.					

Table 8.8.2.1-1: Test Parameters for Localized EPDCCH with TM9

For the parameters specified in Table 8.8.2.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Γ	Test	Bandwidt	Aggregatio	Reference	OCNG	Propagatio	Antenna	Reference value	
	number	h	n level	Channel	Pattern	n Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	12.2
	2	10 MHZ	8 ECCE	R.58 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.5

### 8.8.2.1.1 Void

### Table 8.8.2.1.1-1: Void

8.8.2.1.2 Void

Table 8.8.2.1.2-1: Void

### Table 8.8.2.1.2-2: Void

### Table 8.8.2.1.2-3: Void

## 8.8.2.2 TDD

The parameters specified in Table 8.8.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Parameter		Unit	Value		
Number of PDCCH syr	nbols	symbols	1 (Note 1)		
EPDCCH starting syml	loc	symbols	2 (Note 1)		
PHICH duration			Normal		
Unused RE-s and PRE	-s		OCNG		
Cell ID	-		0		
	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0		
allocation	σ	dB	-3		
	δ	dB	0		
$N_{\scriptscriptstyle oc}$ at antenna port		dBm/15 kHz	-98		
Cyclic prefix			Normal		
Subframe Configuratio	n		Non-MBSFN		
		PRB	1		
Precoder Update Gran	ularity	ms	1		
Beamforming Pre-Cod	er		Annex B.4.5		
Cell Specific Reference			Port 0 and 1		
CSI-RS Reference Sig	nal		Port 15 and 16		
CSI-RS reference sign	al resource		0		
configuration			-		
CSI reference signal su	ubtrame		0		
configuration I <sub>CSI-RS</sub>	an hitman		000001000000000		
ZP-CSI-RS configuration	on bitmap		00000100000000		
CSI-RS	configuration IZP-		0		
Number of EPDCCH S	ets		2 (Note 2)		
EPDCCH Subframe MosubframePatternConfig			1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)		
PDSCH TM			TM9		
TDD UL/DL Configurat	ion		0		
TDD Special Subframe			1 (Note 4)		
		H is signalle	d with epdcch-StartSymbol-r11. However, CFI is		
Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second s for all tests.					
Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by <i>subframePatternConfig-r11</i> . Legacy PDCCH is not scheduled					
Note 4: Demodulation	on performance is a	veraged over	er normal and special subframe.		

#### Table 8.8.2.2-1: Test Parameters for Localized EPDCCH with TM9

For the parameters specified in Table 8.8.2.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.2.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

### Table 8.8.2.2-2: Minimum performance Localized EPDCCH with TM9

ſ	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
ſ	1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	12.8
ſ	2	10 MHZ	8 ECCE	R.58 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.0

8.8.2.2.1 Void

### Table 8.8.2.2.1-1: Void

8.8.2.2.2 Void

Table 8.8.2.2.2-1: Void

Table 8.8.2.2.2-2: Void

### Table 8.8.2.2.2-3: Void

### 8.8.3 Localized transmission with TM10 Type B quasi co-location type

### 8.8.3.1 FDD

For the parameters specified in Table 8.8.3.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.1-2. In Table 8.8.3.1-1, transmission point 1 (TP 1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

## Table 8.8.3.1-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

Do	rameter	Unit	Те	est 1	Tes	st 2		
		Unit	TP 1	TP 2	TP 1	TP 2		
PHICH durat	PHICH duration				ormal			
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0			
power	$ ho_{\scriptscriptstyle B}$	dB			0			
allocation	$\sigma$	dB			-3			
	δ			1	0	1		
$\hat{E}_s/N_{oc}$		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.1- 2	Reference value in Table 8.8.3.1- 2	Reference value in Table 8.8.3.1- 2		
$N_{\scriptscriptstyle oc}$ at anten	na port	dBm/ 15kH z		-	98			
Bandwidth		MHz	10	10	10	10		
Number of co EPDCCH Se				lote 1)	2 (N	ote1)		
EPDCCH-PF (setConfigId)			0	1	0	1		
Transmissior PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized		
Number of P EPDCCH-PF	RB-set	PRB	8	8	8	8		
	amforming model		Annex B.4.5	Annex B.4.5	Annex B.4.5	Annex B.4.5		
PDSCH trans	smission mode		TM10	TM10	TM10	TM10		
PDSCH trans	PDSCH transmission scheduling		Blanked in all the subframes	Transmit in all the subframes	Probability of occurrence of PDSCH transmission is 30% (Note 3)	Probability of occurrence of PDSCH transmission is 70% (Note 3)		
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0		
reference signal (NZPId=1)	CSI reference signal subframe configuration <i>I</i> <sub>CSI-RS</sub>		N/A	2	N/A	2		
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A		
reference signal (NZPId=2)	CSI reference signal subframe configuration I <sub>CSI-RS</sub>		N/A	N/A	2	N/A		
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	000001000000 000	N/A	1000010000000 000		
signal (ZPId=1)	CSI-RS subframe configuration I <sub>CSI-RS</sub>		N/A	2	N/A	2		
Zero power CSI	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	N/A	1000010000000 000	N/A		
reference signal (ZPId=2)	CSI-RS subframe configuration I <sub>CSI-RS</sub>		N/A	N/A	2	N/A		
PQI set 0 (Note 4)	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1		

	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1				
PQI set 1	Non-Zero power CSI RS Identity (NZPId)		N/A	N/A	2	N/A				
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	N/A	2	N/A				
Number c	f PDCCH symbols	Symb ols		1 (Note 2)						
EPDCCH	starting position		pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)				
Subframe	configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN				
Time offse	et between TPs	μs	N/A	2	N/A	2				
Frequenc	y shift between TPs	Hz	N/A	200	N/A	200				
Cell ID			0	126	0	126				
Note 1: Note 2:	Note 1: Resource blocks n <sub>PRB</sub> =0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.									
Note 3:	Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.									
Note 4:	For PQI set 0, PDSCH transmitted from TP1.					and EPDCCH are				

Test	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4
2	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4

## 8.8.3.2 TDD

For the parameters specified in Table 8.8.3.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.2-2. In Table 8.8.3.2-1, transmission point 1 (TP1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

## Table 8.8.3.2-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

Parameter		Unit	Te	est 1	Tes	st 2				
		Unit	TP 1	TP 2	TP 1	TP 2				
PHICH durat	ion			Normal						
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0					
power	$ ho_{\scriptscriptstyle B}$	dB	0							
allocation			-3							
	δ	dB			0					
$\hat{E}_s/N_{oc}$		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.2- 2	Reference value in Table 8.8.3.2- 2	Reference value in Table 8.8.3.2- 2				
$N_{\scriptscriptstyle oc}$ at anter	ina port	dBm/ 15kH z		-	98					
Bandwidth		MHz	10	10	10	10				
	PDCCH Sets			lote 1)		ote1)				
EPDCCH-PF (setConfigId)			0	1	0	1				
PRB-set	n type of EPDCCH-		Localized	Localized	Localized	Localized				
Number of P EPDCCH-PF	RB-set	PRB	8	8	8	8				
	amforming model		Annex B.4.5	Annex B.4.5	Annex B.4.5	Annex B.4.5				
PDSCH trans	smission mode		TM10	TM10	TM10	TM10				
PDSCH transmission scheduling			Blanked in all the subframes	Transmit in all the subframes	Probability of occurrence of PDSCH transmission is 30% (Note 3)	Probability of occurrence of PDSCH transmission is 70% (Note 3)				
	CSI reference signal configurations		Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16				
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0				
reference signal (NZPId=1)	CSI reference signal subframe configuration I <sub>CSI-RS</sub>		N/A	0	N/A	0				
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A				
reference signal (NZPId=2)	CSI reference signal subframe configuration I <sub>CSI-RS</sub>		N/A	N/A	0	N/A				
Zero power CSI	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	0000010000000 000	N/A	100001000000 000				
reference signal (ZPId=1)	CSI-RS subframe configuration I <sub>CSI-RS</sub>		N/A	0	N/A	0				
Zero power CSI	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	N/A	1000010000000 000	N/A				
reference signal (ZPId=2)	CSI-RS subframe configuration I <sub>CSI-RS</sub>		N/A	N/A	0	N/A				

Non-Zero power CSI RS Identity PQI set 0 (NZPId)			N/A	1	N/A	1			
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1			
PQI set 1	PQI set 1 (NZPId)		N/A	N/A	2	N/A			
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	N/A	2	N/A			
Number of PDCCH symbols Ols			1 (Note 2)						
EPDCCH	EPDCCH starting position		pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)	pdsch-Start- r11=2 (Note 2)			
Subframe configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN			
Time offse	Time offset between TPs µ		N/A	2	N/A	2			
Frequenc	y shift between TPs	Hz	N/A	200	N/A	200			
Cell ID			0	126	0	126			
	DL configuration				0				
TDD spec	cial subframe		1						
Note 1:	Resource blocks n <sub>PRB</sub>								
Note 2:	The starting OFDM sy	mbol for I	EPDCCH is deterr	nined from the high	er layer signalling p	dsch-Start-r11.			
	And CFI is set to 1.								
Note 3:	The TP from which PE					or each subframe.			
	Probabilities of occurre								
Note 4:	For PQI set 0, PDSCH					and EPDCCH are			
transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.									

Table 8.8.3.2-2: Minimum Performance

ſ	Test	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6
	2	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6

## 9 Reporting of Channel State Information

## 9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section,

the definition of SNR is in accordance with the one given in clause 8.1.1, where SA

$$NR = \frac{\sum \hat{I}_{or}^{(j)}}{\sum N_{oc}^{(j)}}.$$

## 9.1.1 Applicability of requirements

### 9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

# 9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set. The definition of CA capability is specified in 8.1.2.2.

Table 9.1.1.2-1: Applicability and test rules for CA UE CQI tests with 2 DL CCs

Tests	CA capability where the tests apply	where the tests apply the selected CA capbility where the tests apply				
CA tests with 2CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz			
CA tests with 2CCs in Clause 9.6.1.2	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
Note 1:         The applicability and test rules are specified in this table, unless otherwise stated.           Note 2:         Number of the supported bandwidth combinations to be tested from each selected CA configuration is one.						

## 9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

### 9.2.1.1 FDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Parameter		Unit	Te	st 1	Те	st 2		
Bandwidth		MHz	MHz 10					
PDSCH transmissio	on mode		1					
Downlink power	$\rho_{A}$		0					
allocation	$ ho_{\scriptscriptstyle B}$	dB	0					
	σ	dB			0			
Propagation condition and antenna configuration				AWG	N (1 x 2)			
SNR (Note 2	)	dB	0	1	6	7		
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-98	-97	-92	-91		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98			
Max number of H transmission					1			
Physical channel f reporting	or CQI			PUCCH	Format 2			
PUCCH Report	Туре				4			
Reporting period	dicity	ms		Np	d = 5			
cqi-pmi-Configurati	onIndex				6			
Note 1:       Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.         Note 2:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s)								
		anted signal input lev				0 0111(0)		

### Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

### 9.2.1.2 TDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Paramete	r	Unit	Те	st 1	Te	st 2	
Bandwidth	1	MHz			10		
PDSCH transmiss	on mode				1		
Uplink downlink cor	figuration		2				
Special subfra					4		
configuratio	n				4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0			
allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
	σ	dB			0		
Propagation cond antenna configu				AWG	N (1 x 2)		
SNR (Note		dB	0	1	6	7	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91	
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98 -98			98	
	Max number of HARQ transmissions		1				
Physical channel reporting	for CQI		PUSCH (Note 3)				
PUCCH Report	Type			Δ			
Reporting perio		ms	$N_{\rm pd} = 5$				
cqi-pmi-Configura				F	3		
ACK/NACK feedba				Mult	iplexing		
OCNG Pa TDD with	attern OP.1 <sup>-</sup> two sided d	ient channel RC.1 T TDD as described ir ynamic OCNG Patte	n Annex A.5.2 ern OP.2 TDI	2.1, except for D as describe	r category 1 UI d in Annex A.5	E use RC.4 .2.2.	
<ul> <li>Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.</li> </ul>							

### Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

### 9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Parameter		Unit		Tes	st 1		Te	st 2	
Parameter			Ce		Cell 2	Ce	ell 1	Cell 2	
Bandwidth				1(	-			0	
PDSCH transmission			2		Note 10		2	Note 10	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3				3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3				-3	
	σ	dB		0				)	
Propagation condit antenna configu			(	Clause B	3.1 (2x2)		Clause I	3.1 (2x2)	
$\widehat{E}_{s} ig / N_{oc2}$ (Not	te 1)	dB	4	5	6	4	5	-12	
r(i)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (N	Note 7)	N/A		lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	ote 8)	N/A		lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (I	Note 9)	N/A	-98(N	lote 9)	N/A	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110	
Subframe Config	uration		Non-M	BSFN	Non-MBSFN	Non-N	/BSFN	Non-MBSFN	
Cell Id			(		1		0	1	
Time Offset betwee	en Cells	μs	2.5	(synchro	onous cells)	2.5	5 (synchr	onous cells)	
ABS pattern (Note 2)			N/A		01010101 01010101 01010101 01010101 01010101 01010101	N/A		01010101 01010101 01010101 01010101 01010101 01010101	
RLM/RRM Measurement Subframe Pattern (Note 4)			00000100 00000100 00000100 00000100 00000100		N/A	00000100 00000100 00000100 00000100 00000100		N/A	
CSI Subframe Sets			0101 0101 0101 0101 0101 0101	0101 0101 0101 0101 0101	N/A	0101 0101 0101 0101	10101 10101 10101 10101 10101 10101	N/A	
(Note 3)	C <sub>CSI,1</sub>		1010 1010 1010 1010 1010 1010	1010 1010 1010 1010 1010	N/A	1010 1010 1010 1010	01010 01010 01010 01010 01010 01010	N/A	
Number of control symbols	OFDM			3	}			3	
Max number of H transmission	Max number of HARQ			1				1	
Physical channel for reporting			F	PUCCH F	Format 2		PUCCH	Format 2	
Physical channel for reporting	C <sub>CSI,1</sub> CQI		F	PUSCH (	Note 12)		PUSCH	(Note 12)	
PUCCH Report	Туре			4	ļ			4	
Reporting perio	dicity	Ms		N <sub>pd</sub>	= 5		Npd	= 5	
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1	3)		6	;	N/A		6	N/A	
cqi-pmi-Configuratio C <sub>CSI,1</sub> (Note 1	onIndex2		5	5	N/A		5	N/A	

Table 9.2.1.3-1: PUCCH 1-0 static test (FDD)
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Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the
	respective wanted signal input level.
Note 2:	ABS pattern as defined in [9].
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	
Note 11:	Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2.
Note 12:	To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
Note 13:	$cqi$ -pmi-ConfigurationIndex is applied for $C_{CSI,0}$ .
Note 14:	$cqi$ -pmi-ConfigurationIndex2 is applied for $C_{CSI,1}$

### 9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Demonster		11		Tes	st 1		Те	st 2	
Parameter		Unit	Ce		Cell 2	Ce	ll 1	Cell 2	
Bandwidth		MHz			0			10	
PDSCH transmissio			2	2	Note 10	:	2	Note 10	
Uplink downlink conf					1			1	
Special subfra configuratior				2	4			4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-	3		-	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-	3		-3		
	σ	dB		(	C			0	
Propagation condit antenna configur				Clause I	B.1 (2x2)		Clause	B.1 (2x2)	
$\widehat{E}_{s}/N_{oc2}$ (Not		dB	4	5	6	4	5	-12	
()	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (1	Note 7)	N/A	-98 (N	lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	-98 (N	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (l	Note 9)	N/A	-98 (N	lote 9)	N/A	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110	
Subframe Configuration			Non-M	IBSFN	Non-MBSFN	Non-N	IBSFN	Non-MBSFN	
Cell Id			(	)	1	0		1	
Time Offset between Cells		μs	2.5 (synchro		onous cells)	2.5 (synchr		onous cells)	
ABS pattern (No	ABS pattern (Note 2)		N/A		0100010001 0100010001	N/A		0100010001 0100010001	
RLM/RRM Measu Subframe Pattern (			00000		N/A	0000000001 0000000001		N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000	10001	N/A	01000	)10001 )10001	N.A	
(Note 3)	C <sub>CSI,1</sub>		10001	01000 01000	N/A	1000101000		N/A	
Number of control	OFDM		10001		۱ ۲	10001		2	
symbols					3	3		ა 	
Max number of H transmission					1			1	
Physical channel for reporting				PUCCH	Format 2		PUCCH	Format 2	
Physical channel for	C <sub>CSI,1</sub> CQI			PUSCH	(Note 12)		PU	SCH	
reporting PUCCH Report Type				4	4			4	
Reporting period		ms			= 5		$\frac{4}{N_{\rm pd} = 5}$		
cqi-pmi-Configurati									
C <sub>CSI,0</sub> (Note 1	3)		3	)	N/A	· ·	3	N/A	
cqi-pmi-Configuratio C <sub>CSI,1</sub> (Note 1			2	1	N/A		4	N/A	
ACK/NACK feedbad				Multip	lexing		Multip	blexing	

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the
11010 1.	respective wanted signal input level.
Note 2:	ABS pattern as defined in [9].
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the
	same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping
	with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as
	defined in Annex A.5.2.5
Note 11:	Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category ≥2 with one
	sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table
	A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1
	and Annex A.5.2.2.
Note 12	To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH
Note 12.	
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic
	CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
Note 13:	cqi-pmi-ConfigurationIndex is applied for C <sub>CSI,0</sub> .
Note 14:	<i>cqi-pmi-ConfigurationIndex2</i> is applied for C <sub>CSI,1</sub>

## 9.2.1.5 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.5-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by the set of the median CQI is greater than 0.1. If the PDSCH BLER in ABS subframes using transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. The BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Parameter		Unit	Test 1 Test 2				
			Cell 1	Cell 2 and 3	Cell 1	Cell 2 and 3	
Bandwidth PDSCH transmissio	n modo	MHz	1	0 Note 10	2	0 Note 10	
		dB				Note 10	
Downlink power $\rho_A$ allocation $\rho_B$							
		dB	-;			3	
Propagation condit	σ ion and	dB	(			)	
antenna configu			Clause E	3.1 (2x2)	Clause I	3.1 (2x2)	
$\widehat{E}_{s} ig / N_{oc2}$ (Not		dB	4 5	Cell 2: 12 Cell 3: 10	13 14	Cell 2: 12 Cell 3: 10	
( <i>i</i> )	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (Note 7)	N/A	-98 (Note 7)	N/A	
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)	N/A	-98 (Note 8)	N/A	
·	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9)	N/A	-93 (Note 9)	N/A	
Subframe Configu	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN	
Cell Id			0	Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1	
Time Offset betwee	en Cells	μs	Cell 2:	3 usec		3 usec	
		•	Cell 3: Cell 2:		Cell 3: -1usec Cell 2: 300Hz		
Frequency Shift betw	een Cells	Hz	Cell 3:		Cell 3: -100Hz		
ABS pattern (No	ote 2)		N/A	01010101 01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101 01010101	
RLM/RRM Measu Subframe Pattern (			00000100 00000100 00000100 00000100 00000100	N/A	00000100 00000100 00000100 00000100 00000100	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01010101 01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101 01010101	N/A	
(Note 3)	C <sub>CSI,1</sub>		10101010 10101010 10101010 10101010 10101010	N/A	10101010 10101010 10101010 10101010 10101010 10101010	N/A	
Number of control symbols	OFDM		3	3		3	
Max number of H transmission			1			1	
Physical channel for reporting			PUCCH	Format 2	PUCCH	Format 2	
Physical channel for reporting	C <sub>CSI,1</sub> CQI		PUSCH (	(Note 12)	PUSCH	(Note 12)	
PUCCH Report	Туре			1		1	
Reporting period		Ms	N <sub>pd</sub>	= 5	N <sub>pd</sub>	= 5	
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1	3)		6	N/A	6	N/A	
cqi-pmi-Configuratio			5	N/A	5	N/A	

### Table 9.2.1.5-1: PUCCH 1-0 static test (FDD)

Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the
	respective wanted signal input level.
Note 2:	ABS pattern as defined in [9].
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7]
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1,
	Cell2, and Cell3 are the same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe
	overlapping with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor
	ABS.
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG
	pattern as defined in Annex A.5.1.5
Note 11:	Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided dynamic
	OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
Note 12:	To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic
	CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
Note 13:	<i>cqi-pmi-ConfigurationIndex</i> is applied for C <sub>CSI,0</sub>
Note 14:	$cqi$ -pmi-ConfigurationIndex2 is applied for $C_{CSI,1}$ .

## 9.2.1.6 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.6-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by the set of the median CQI is greater than 0.1. If the PDSCH BLER in ABS subframes using transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. The BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

_				Test 1 Test 2					
Parameter		Unit	Ce	<u>   1</u>	Cell 2 and 3	Ce	ell 1	Cell 2 and 3	
Bandwidth		MHz			0		10		
PDSCH transmission			2	2	Note 10	_		Note 10	
Uplink downlink con					1			1	
Special subfra configuratio				2	4			4	
	$ ho_{\scriptscriptstyle A}$	dB		-	3		-	3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-	3		-	3	
anocation	σ	dB		(	)			0	
Propagation condi antenna configu	tion and			Clause E	3.1 (2x2)		Clause I	B.1 (2x2)	
$\widehat{E}_{s}ig/N_{oc2}$ (No	te 1)	dB	4	5	Cell 2: 12 Cell 3: 10	13	14	Cell 2: 12 Cell 3: 10	
(.)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (N	lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	-98 (N	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (N	lote 9)	N/A	-93 (N	lote 9)	N/A	
Subframe Config	uration		Non-M	1BSFN	Non-MBSFN	Non-N	/IBSFN	Non-MBSFN	
Cell Id			(	C	Cell 2: 6 Cell 3: 1			Cell 2: 6 Cell 3: 1	
Time Offset betwe	en Cells	μs	Cell 2: 3 usec Cell 3: -1usec		Cell 2: 3 usec		Cell 2: 3 usec Cell 3: -1usec		
Frequency shift betw	veen Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz		Cell 2: 300Hz Cell 3: -100Hz		300Hz		
ABS pattern (No	ote 2)		N	/A	0100010001 0100010001	N	/A	0100010001 0100010001	
RLM/RRM Measu Subframe Pattern			00000		N/A		)00001 )00001	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000	10001	N/A	0100010001 0100010001		N.A	
(Note 3)	C <sub>CSI,1</sub>			01000 01000	N/A		01000 01000	N/A	
Number of control symbols	OFDM			(	3		:	3	
Max number of H transmissior	าร				1			1	
Physical channel for reporting	C <sub>CSI,0</sub> CQI			PUCCH	Format 2		PUCCH	Format 2	
Physical channel for reporting	C <sub>CSI,1</sub> CQI			PUSCH	(Note 12)		PUSCH	(Note 12)	
PUCCH Report	Туре		4		4		4		
Reporting perio	dicity	ms	$N_{\rm pd} = 5$		$N_{\rm pd} = 5$		= 5		
cqi-pmi-Configurata C <sub>CSI,0</sub> (Note 1	3)		3	3	N/A		3	N/A	
cqi-pmi-Configuratio	onIndex2		4	4	N/A		4	N/A	
ACK/NACK feedba				Multip	lexing		Multip	lexing	

## Table 9.2.1.6-1: PUCCH 1-0 static test (TDD)

Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
Note 2:	ABS pattern as defined in [9].
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
Note 11:	Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
Note 12:	To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic
Note 12	CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
	cqi-pmi-ConfigurationIndex is applied for C <sub>CSI,0</sub> .
INOTE 14:	cgi-pmi-ConfigurationIndex2 is applied for C <sub>CSL1</sub>

# 9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

### 9.2.2.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Parameter		Unit	Tes	st 1	Те	st 2	
Bandwidth		MHz		10			
PDSCH transmission	on mode	4					
Downlink power $\rho_A$		dB	-3				
allocation	Downlink power		-3				
	σ	dB			0		
Propagation condit antenna configu				Clause	B.1 (2 x 2)		
CodeBookSubsetRe bitmap				01	0000		
SNR (Note 2	<u>2)</u>	dB	10	11	16	17	
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-88	-87	-82	-81	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	-98 -98			
Max number of H transmission			1				
Physical channel for reporting	CQI/PMI		PUCCH Format 2				
PUCCH Report T CQI/PMI	/pe for				2		
PUCCH Report Typ	be for RI				3		
Reporting period	dicity	ms		Np	<sub>d</sub> = 5		
cqi-pmi-Configurati	onIndex				6		
ri-ConfigInde				1	lote 3)		
OCNG Pat Note 2: For each t	ttern OP.1 est, the mir	ent channel RC.2 F FDD as described ir himum requirements	h Annex A.5.1 shall be fulfil	.1.		-	
Note 3: It is intend	ed to have	anted signal input le UL collisions betwee he eNB in this test.		and HARQ-A	CK, since the	RI reports	

### Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

### 9.2.2.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1$ +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

	Parameter		Unit	Те	st 1	Те	st 2	
	Bandwidth MHz 10							
PDSCH	transmissic	on mode		4				
	wnlink conf			2				
	ecial subfrai configuratior				4			
Downlin	k power	$ ho_{\scriptscriptstyle A}$	dB			-3		
	ation	$ ho_{\scriptscriptstyle B}$	dB			-3		
		σ	dB			0		
	ation condit				Clause E	3.1 (2 x 2)		
CodeBo	okSubsetRe bitmap	estriction			010	0000		
S	SNR (Note 2	<u>'</u> )	dB	10	11	16	17	
	$\hat{I}_{or}^{(j)}$	/	dB[mW/15kHz]	-88	-87	-82	-81	
	N <sup>(j)</sup> <sub>oc</sub> dB[mW/15kHz] -98			-1	-98			
	number of H					1		
	transmissions					•		
Physical	Physical channel for CQI/PMI reporting				PUSCH	l (Note 3)		
PUC	CH Report	Туре				2		
	orting period		ms		Npg	u = 5		
	-Configurati					3		
ri	-ConfigInde	X			805 (I	Note 4)		
ACK/NA	CK feedbad	ck mode			Multip	olexing		
Note 1: Note 2:	OCNG Pat	tern OP.1	ient channel RC.2 T TDD as described ir imum requirements	n Annex A.5.2	2.1.		5	
NOLE Z.			anted signal input le		lieu iui al ieas		10 SINK(S)	
Note 3:			tween CQI/PMI rep		RQ-ACK it is ne	ecessarv to re	port both on	
			JCCH. PDCCH DCI					
		periodic C	QI/PMI to multiplex					
Note 4:	RI reportin between R expected t	g interval is I, CQI/PMI hat CQI/PN	s set to the maximur and HARQ-ACK re Il reports will be dro ction shall be skippe	ports. In the pped, while	case when all RI and HARQ-	three reports ACK will be m	collide, it is nultiplexed. At	

### Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

## 9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

### 9.2.3.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

	Parameter	-	Unit	Te	st 1	Tes	st 2		
	Bandwidth		MHz			10			
PDS	CH transmissi	on mode				9			
		$ ho_{\scriptscriptstyle A}$	dB	dB			0		
	link power	$ ho_{\scriptscriptstyle B}$	dB			0			
alle	ocation	$P_c$	dB		-3				
		σ	dB			-3			
Cell-s	pecific reference	ce signals			Antenna	ports 0, 1			
	SI reference si					orts 15,,18			
	S periodicity an				ľ	, ,			
	offset				Ę	5/1			
	$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	RS							
CSI refe	erence signal c	onfiguration				0			
Propaga	ation condition a	and antenna			Clause	B.1 (4 x 2)			
	configuratio				Clause	D. I (4 X Z)			
	Beamforming N				As specified i	n Section B.4.3	3		
CodeBo	okSubsetRestr			0x0000 0000 0100 0000					
	SNR (Note 2)		dB	7	8	13	14		
	$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-91	-90	-85	-84		
	$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	8		
Max num	ber of HARQ t	ransmissions				1			
Phys	ical channel for	CQI/PMI			DUSC	H (Note3)			
	reporting				FUSC	T (NOLES)			
PUCCH	Report Type f	or CQI/PMI				2			
	al channel for F				PUCCH	Format 2			
	CH Report Typ					3			
F	Reporting perio	dicity	ms		Np	<sub>d</sub> = 5			
	CQI delay		ms			8			
cqi-	pmi-Configurat	ionIndex				2			
	ri-ConfigInde					1			
Note 1:	Reference m	easurement ch	annel RC.7 TDD ac	cording to Ta	ble A.4-1 with	n one sided dyr	namic OCNG		
			ibed in Annex A.5.1						
Note 2:		, the minimum anted signal inp	requirements shall	be fulfilled for	at least one o	of the two SNR	(s) and the		
Note 3:			CQI/PMI reports ar	d HARQ-ACI	K it is necessa	arv to report bo	oth on		
			PDCCH DCI forma						
			ultiplex with the HA						

Table 9.2.3.1-1: PUCCH 1-1 static test (FDD)

### 9.2.3.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1$  +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Parameter	•	Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz			10	
PDSCH transmissi					9	
Uplink downlink con					2	
Special subframe co	nfiguration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	dB			0		
allocation	$P_c$	dB			-6	
	σ	dB			-3	
CRS reference s					ports 0, 1	
CSI reference si				Antenna p	orts 15,,22	
CSI-RS periodicity an offset T <sub>CSI-RS</sub> / ∆ <sub>CSI-</sub>				5	5/3	
CSI reference signal c					0	
Propagation condition a					-	
configuratio	n				B.1 (8 x 2)	
Beamforming N					n Section B.4.	
CodeBookSubsetRestr				0x0000 0000 0020 0000 0000		
SNR (Note 2	2)	dB	4	5	10	11
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-88	-87
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-98	
Max number of HARQ t	ransmissions				1	
Physical channel for	CQI/PMI			PUSCH	I (Note 3)	
reporting				10001		
PUCCH Report Type fo PMI	r CQI/second			:	2b	
Physical channel for F	RI reporting			PU	SCH	
PUCCH Report Type fo	r RI/ first PMI				5	
Reporting perio	dicity	ms		Np	<sub>d</sub> = 5	
CQI delay		ms		10	or 11	
cqi-pmi-Configurat	ionIndex				3	
ri-ConfigInde				805 (	Note 4)	
ACK/NACK feedba					plexing	
		annel RC.7 TDD ac		ble A.4-1 with	n one sided dyr	namic OCNG
		ibed in Annex A.5.2				
Note 2: For each test	, the minimum	requirements shall	be fulfilled for	at least one of	of the two SNR	R(s) and the
	anted signal inp					
		CQI/PMI reports an				
		PDCCH DCI forma				
		ultiplex with the HA the maximum allow				
		K reports. In the cas				
		pped, while RI and H				
		every 160ms during			NEU. AL END, C	
	an be skipped e	and a second during	Periorinance	vonnoation.		

## 9.2.4 Minimum requirement PUCCH 1-1 (With Single CSI Process)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

### 9.2.4.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.4.1-1, and using the downlink physical channels specified in tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial

differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

### wideband $CQI_1$ = wideband $CQI_0$ – Codeword 1 offset level

The wideband CQI<sub>1</sub> shall be within the set {median CQI<sub>1</sub>-1, median CQI<sub>1</sub>, median CQI<sub>1</sub>+1} for more than 90% of the time, where the resulting wideband values CQI<sub>1</sub> shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI<sub>0</sub> – 1 and median CQI<sub>1</sub> – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI<sub>0</sub> + 1 and median CQI<sub>1</sub> + 1 shall be greater than or equal to 0.1.

Paramet	er	Unit	Tes			Tes	-		
			TP1	TP		TP1	TP2		
Bandwid		MHz				0			
PDSCH transmis	sion mode				1	0			
	$ ho_{\scriptscriptstyle A}$	dB	0	C	)	0	C	)	
Downlink power $\rho_B$		dB	0	C	)	0	(	)	
allocation (Note 1)	Pc	dB	-3	-3		-3	-;	3	
	σ	dB	-3	N/		-3		0 0 -3 N/A (Note 2) N/A N/A N/A 1 / 1000000000 00000 N/A PUCCH 1-1 Clause B.1 (2 x 2) 100000 14 15	
Cell ID			C	)		C	)		
			Antenna ports	,		Antenna ports			
Cell-specific refere	nce signals		0, 1	(Not	e 2)	0, 1	(Not	e 2)	
CSI reference	signals		Antenna ports 15,,18	N/	A	Antenna ports 15,,18	N/	Ά	
CSI-RS periodi subframe offset $T_{C}$			5/1	N/	A	5/1	N/	Ά	
CSI-RS config			0	N/	A	0	N/	Ά	
Zero-Power C configurat I <sub>CSI-RS</sub> / ZeroPow bitmap	ion erCSI-RS		1 / 00100000000 0000	1 100000 000	00000	1 / 00100000000 0000	100000	00000	
CSI-IM config I <sub>CSI-RS</sub> / ZeroPow bitmap	uration erCSI-RS		1 / 00100000000 0000	N/	A	1 / 00100000000 0000	N/A		
CSI process con Signal/Interference mode	figuration		CSI-RS/CSI-IN	Л/PUCCH 1-1		CSI-RS/CSI-IM/PUCCH 1		11-1	
Propagation con	Propagation condition and antenna configuration		Clause B.1 (4 x 2)	Claus (2 x		Clause B.1 (4 x 2)			
CodeBookSubset bitmap	Restriction		0x0000 0000 0100 0000	100000		0x0000 0000 0100 0000			
SNR (Note		dB	20	6	7	20	14	15	
$\hat{I}_{or}^{(j)}$	,	dB[mW/15kHz]	-78	-92	-91	-78	-84	-83	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-9	8			
Modulation / Infor payload			(Note4)	QPSK / 4392		(Note4)	QPSK	/ 4392	
Max number of transmissi	f HARQ		1	N/	A	1	N/	Ά	
Physical channel f	or CQI/PMI		PUSCH (Note5)	N/	A	PUSCH (Note5)	N/	Ά	
PUCCH Report CQI/PM	Type for		2	N/	A	2	N/	Ά	
PUCCH Report T			3	N/	A	3	N/	Ά	
Reporting per		ms	$N_{\rm pd} = 5$	N/		$N_{\rm pd} = 5$	N/		
CQI Dela	ay	ms	8	N/		8	N/	Ά	
cqi-pmi-Configura			2	N/		2	N/	Ά	
ri-ConfigIn			1	N/	A	1	N/	Ά	
PDSCH scheduled			1,2,3,4,	6,7,8,9		1,2,3,4,	6,7,8,9		
Timing offset bet		US	0	)		C	)		
Frequency offset b		Hz	C	-		C			
OP.1 FDI Note 2: REs for a Note 3: For each	D as described intenna ports (	d in Annex A.5.1.1 ) and 1 CRS have num requirements	zero transmission	power.		one sided dynamic he two SNR(s) and			
						to report both on F			

Table 9.2.4.1-1: PUCCH 1-1 static test (FDD)
----------------------------------------------

Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

### 9.2.4.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.4.2-1, and using the downlink physical channels specified in tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1$  +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

Paramete	۶r	Unit	Tes			Tes			
			TP1	TP		TP1	TF	2	
Bandwidth		MHz				10			
PDSCH transmission mode				10 2					
Uplink downlink configuration						<u> </u>			
Special subframe configuration		dB	0 0				(	<b>`</b>	
Downlink power $\rho_B$ allocation (Note 1) $P_c$ $\sigma$			-	-					
		dB	0	0		0	(		
		dB dB	-6	-6		-6	-(		
	σ		-3	N/	A	-3	N	/A	
Cell ID			C	)		C	)		
Cell-specific referen	nce signals		Antenna ports 0, 1	(Not	e 2)	Antenna ports 0, 1	(Not	e 2)	
CSI reference	signals		Antenna ports 15,,22	N/	A	Antenna ports 15,,22	N	/A	
CSI-RS periodic subframe offset T <sub>CS</sub>			5/3	N/	A	5/3	N	/A	
CSI-RS configu			0	N/	A	0	N	/A	
Zero-Power C configurati I <sub>CSI-RS</sub> / ZeroPowe bitmap	on		3 / 001000000000 0000	3 100001 000	00000	3 / 00100000000 0000	3 100001 000	00000	
CSI-IM configu I <sub>CSI-RS</sub> / ZeroPowe bitmap	erCSI-RS		3 / 00100000000 0000	N/A		3 / 00100000000 0000	N	N/A	
CSI process configuration Signal/Interference/Reporting mode			CSI-RS/CSI-IN	SI-IM/PUCCH 1-1		CSI-RS/CSI-IN	//PUCCŀ	H 1-1	
Propagation conc antenna config			Clause B.1 (8 x 2)	Clause B.1 (2 x 2)		Clause B.1 (8 x 2)	Clause B.1 (2 x 2)		
CodeBookSubsetF bitmap	Restriction		0x0000 0000 0020 0000 0000 0001 0000	100000		0x0000 0000 0020 0000 0000 0001 0000	100	000	
SNR (Note	3)	dB	17	6	7	17	14	15	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-81	-92	-91	-81	-84	-83	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	8		-9	98		
Modulation / Infori payload			(Note4)	QPSK	/ 4392	(Note4)	QPSK	/ 4392	
Max number of transmissic	ons		1	N/	A	1	N	/Α	
Physical channel for reporting	1		PUSCH (Note5)	N/	A	PUSCH (Note5)	N	/Α	
PUCCH Report CQI/second	PMI		2b	N/		2b		/A	
Physical channel for RI reporting			PUSCH	N/	A	PUSCH	N	/Α	
PUCCH Report Type for RI/ first PMI			5	N/		5	N/		
Reporting perio		ms	$N_{\rm pd} = 5$	N/		$N_{\rm pd} = 5$	N/		
CQI Dela cqi-pmi-Configura		ms	10 or 11 3	N/		10 or 11 3	N/		
ri-ConfigInd			805 (Note 6)	N/		805 (Note 6)	N/		
ACK/NACK feedb			Multiplexing	N/		Multiplexing	N/		
PDSCH scheduled			3,4,			3,4,			
Timing offset betv		us	0,1,			C			
Frequency offset be		Hz	C	)		0			

Table 9.2.4.2-1:	PUCCH 1-1	static test	(TDD)
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Note1:	Reference measurement channel RC.10 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
Note 2:	REs for antenna ports 0 and 1 CRS have zero transmission power.
Note 3:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
Note 4:	Void
Note 5:	To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to
	multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
Note 6:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI,
	CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports
	will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped
	every 160ms during performance verification.

## 9.3 CQI reporting under fading conditions

## 9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

### 9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

### 9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Parameter		Unit	Tes	Test 1 Test 2			
Bandwidth		MHz		10 MHz			
Transmission mode			1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0				
power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	σ	dB	0				
SNR	(Note 3)	dB	9	10	14	15	
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-89	-88	-84	-83	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
_			Clause	B.2.4 wi	th $ au_d=0$	).45 <i>μ</i> s,	
Propaga	tion channel			a=1, f	$T_D = 5 \text{ Hz}$		
Antenna	configuration			<u>1 x 2</u> 5			
Report	ng interval	ms					
QC	l delay	ms	8				
	ting mode		PUSCH 3-0				
	and size	RB	6 (full size)				
	ber of HARQ missions		1				
Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in				than blied at A.4-1			
Note 3: F	Annex A.5.1.1/2. For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.						

#### Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

	Test 1	Test 2
α[%]	2	2
$\beta$ [%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

#### 9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Para	meter	Unit	Те	st 1	Tes	t 2	
Bandwidth		MHz		10 MHz			
Transmission mode				1 (p	ort 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	0		
power	power $\rho_{\scriptscriptstyle B}$			(	0		
allocation	σ	dB	0				
config	downlink uration			2			
config	subframe uration				4		
SNR (	Note 3)	dB	9	10	14	15	
Î	(j) or	dB[mW/15kHz]	-89	-88	-84	-83	
N	r(j) oc	dB[mW/15kHz]	-98 -98			8	
			Clause B.2.4 with				
Propagati	on channel		$ au_{d}=0.45\mu{ m s},a=1,$			1,	
				$\frac{f_D = 5 \text{ Hz}}{1 \text{ x } 2}$			
	onfiguration		1 x 2				
	g interval	ms					
	delay	ms	10 or 11				
	ng mode		PUSCH 3-0				
	and size	RB	6 (full size)				
	er of HARQ				1		
	nissions						
	edback mode				plexing		
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)					than		
Note 2: Ref with in A						cribed	
		ninimum requirements (s) and the respect					

 Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

# 9.3.1.1.3 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Parameter		Unit		Tes			st 2		
Bandwidth		MHz	Cel	<b>11</b> 10	Cell 2 and 3	Cell 1	<b>Cell 2 and 3</b>		
PDSCH transmission mode		IVIEZ	1		Note 10	1	Note 10		
Downlink power $\rho_A$		dB		0		0			
		dB		0	1	0			
allocation	σ	dB	0				0		
Propagation condition			Clause B.2.4 with Td = 0.45 us, a = 1, fd =		th Td = $0.45$		EVA5 Low antenna correlation		
Antenna configu	ration		1x2		1	x2			
${\widehat E}_{s} ig/ N_{oc2}$ (Not	e 1)	dB	4	5	Cell 2: 12 Cell 3: 10	14 15	Cell 2: 12 Cell 3: 10		
$\mathbf{r}(i)$	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (No	ote 7)	N/A	-98 (Note 7)	N/A		
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (No	ote 8)	N/A	-98 (Note 8)	N/A		
·	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (No	ote 9)	N/A	-93 (Note 9)	N/A		
Subframe Config	uration		Non-M	BSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN		
Cell Id			0		Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1		
Time Offset betwee	en Cells	μs	Cell 2: 3 usec Cell 3: -1usec		Cell 2: 3 usec Cell 3: -1usec				
Frequency Shift betw	veen Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz			Cell 2: 300Hz Cell 3: -100Hz			
ABS pattern (Note 2)			N/A 01010101 01010101		01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101 01010101		
RLM/RRM Measurement Subframe Pattern (Note 4)			00000100 00000100 00000100 N/A 00000100 00000100			00000100 00000100 00000100 00000100 00000100	N/A		
C <sub>CSI,0</sub> CSI Subframe Sets			01010 01010 01010 01010 01010	0101 0101 0101 0101 0101	N/A	01010101 01010101 01010101 01010101 01010101 01010101	N/A		
(Note 3)	C <sub>CSI,1</sub>		10101010 10101010 10101010 10101010		10101010 10101010 10101010		N/A	10101010 10101010 10101010 10101010 10101010 10101010	N/A
Number of control OFDM symbols			3		3				
Max number of F transmission			1		1				
CQI delay		ms			8	3			
Reporting interval (		ms	10						
Reporting mo			PUSCH 3-0						
Sub-band size		RB	6 (full size)						

Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
Note 2:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
Note 11:	Reference measurement channel in Cell 1 RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
Note 12:	downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at
	the eNB downlink before SF#(n+4).
Note 13:	The CSI reporting is such that reference subframes belong to $C_{csi,0}$ .

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
3	0.01	0.01
UE Category	≥1	≥1

#### Table 9.3.1.1.3-2 Minimum requirement (FDD)

# 9.3.1.1.4 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Parameter		Unit	Unit Test 1				Test 2		
			Ce		Cell 2 and 3	Ce		Cell 2 and 3	
Bandwidth		MHz		1	0		1	0	
PDSCH transmission mode			1	1	Note 10	-	1	Note 10	
Uplink downlink conf	iguration				1			1	
Special subframe				4	1		4		
configuration	1								
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		(		0		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0		)	0		0	
	σ	dB			)			0	
Propagation condition			Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz		EVA5 Low antenna correlation	Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz		EVA5 Low antenna correlation	
Antenna configuratio	n			1)			1:	x2	
$\widehat{E}_{s} \big/ N_{oc2}$ (Note 1)		dB	4	5	Cell 2: 12 Cell 3: 10	14	15	Cell 2: 12 Cell 3: 10	
( ;)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (N	lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)		N/A	-98 (Note 8)		N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9)		N/A	-93 (Note 9)		N/A	
Subframe Configuration			Non-MBSFN		Non-MBSFN	Non-MBSFN		Non-MBSFN	
Cell Id			0		Cell 2: 6 Cell 3: 1	0		Cell 2: 6 Cell 3: 1	
Time Offset between	Cells	μs	Cell 2: 3 usec Cell 3: -1usec		Cell 2: 3 usec Cell 3: -1usec				
Frequency shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz		Cell 2: 300Hz Cell 3: -100Hz				
ABS pattern (Note 2)					0100010001 0100010001	N/A		0100010001 0100010001	
RLM/RRM Measurer Subframe Pattern (N			0000000001 0000000001		N/A		00001	N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000		N/A	01000 01000		N.A	
(Note 3)	C <sub>CSI,1</sub>		10001	01000 01000	N/A	10001	01000 01000	N/A	
Number of control OFDM symbols			3		3				
Max number of HARQ transmissions			1				1		
CQI delay		ms			1	0			
Reporting interval (Note 13)		ms				0			
Reporting mode						CH 3-0			
Sub-band size		RB	6 (full size)						
ACK/NACK feedback mode			Multiplexing Multiplexing					lexing	

Table 9.3.1.1.4-1 Sub-band test for single antenna transmission (TDD)

Note 1:	For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
Note 2:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
Note 3:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 4:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
Note 7:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 8:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 9:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
Note 10:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
Note 11:	Reference measurement channel in Cell 1 RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
Note 12:	If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
Note 13:	The CSI reporting is such that reference subframes belong to C <sub>csi,0</sub> .

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1

0.01

≥1

0.01

≥1

Table 9.3.1.1.4-2 Minimum requirement (TDD)

#### 9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

ε UE Category

#### 9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

Para	meter	Unit	Test 1 Test 2		st 2	
Banc	lwidth	MHz		10 MHz		
Transmis	Transmission mode		9			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	P <sub>c</sub>	dB	0			
	σ	dB	0			
SNR (	Note 3)	dB	4	5	11	12
Î	(j) pr	dB[mW/15kHz]	-94	-93	-87	86
N	r(j) oc	dB[mW/15kHz]	-9	-98 -98		
			Clause	Clause B.2.4 with $\tau_d = 0.45 \mu s$		
Propagation	on channel			a = 1, f	$f_D = 5 \text{ Hz}$	
Antenna co	onfiguration	$a = 1, f_D = 5 \text{ Hz}$				
	ning Model		As sp	pecified in	n Section	B.4.3
	ence signals		' 		a ports 0	
CSI refere	nce signals		Antenna ports 15, 16			16
CSI-RS periodicity	and subframe offset					
	$/\Delta_{CSI-RS}$	5/ 1				
	signal configuration		4			
	Restriction bitmap			000	0001	
Reporting interval (Note 4)		ms	ms 5			
CQI delay ms		8				
Reporting mode					CH 3-1	
Sub-band size		RB	6 (full size)			
Max number of HARQ transmissions 1						
<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.8 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two</li> </ul>						
Note 3.       For each test, the minimum requirements shall be furnied for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.						

Table 9.3.1.2.1-1	Sub-band test for FDD
-------------------	-----------------------

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1

≥1

≥1

**UE** Category

# 9.3.1.2.2 TDD

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

Para	ameter	Unit	Test 1 Test 2		st 2		
Bar	dwidth	MHz	10 MHz				
Transmi	ssion mode		9				
Uplink downl	nk configuration		2				
Special subfra	me configuration				4		
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	$P_c$	dB	0				
	σ	dB	0				
SNR	(Note 3)	dB	4	5	11	12	
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-94	-93	-87	-86	
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-9	-98	
			Clause	Clause B.2.4 with $\tau_d = 0.45 \mu s$			
Propaga	tion channel		$a = 1, f_D = 5 \text{ Hz}$				
Antenna configuration			2x2				
Beamforming Model			As specified in Section B.4.3		B.4.3		
CRS reference signals					na port 0		
	nce signals Antenna port 1						
CSI-RS periodicity and subframe offset				5	/ 3		
	$_{\rm S}$ / $\Delta_{\rm CSI-RS}$			5	/ 3		
	signal configuration		4				
CodeBookSubsetRestriction bitmap 000001		0001					
Reporting ir	Reporting interval (Note 4) ms 5						
CQI delay		ms	10				
Reporting mode					CH 3-1		
Sub-band size		RB	6 (full size)				
Max number of HARQ transmissions					1		
ACK/NACK feedback mode					olexing		
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on							
	mation at a downlink su					bband	
or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)							
Note 2: Reference measurement channel RC.8 TDD according to Table A.4-1 with one/two							
sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.							
SNR(s) and the respective wanted signal input level.							
	DCI format 0 with a trig						
SF#3 an	d #8 to allow aperiodic	CQI/PMI/RI to be trar	nsmitted	on uplink	SF#2 ar	nd #7.	

<b>-</b>	
Table 9.3.1.2.2-1	Sub-band test for TDD

Table 9.3.1.2.2-2 Minimum	requirement (TDD)
---------------------------	-------------------

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	≥1	≥1

# 9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

### 9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

#### 9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

Para	meter	Unit	Tes	st 1	Tes	st 2
Ban	dwidth	MHz	10 MHz			
Transmis	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
SNR	(Note 3)	dB	6	7	12	13
ĺ	r(j) or	dB[mW/15kHz]	-92	-91	-86	-85
	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98		98
Propagat	ion channel			EP	A5	
	ation and			High (	1 x 2)	
	onfiguration			PUCC	. ,	
	periodicity	ms			= 2	
	delay	ms		, vpa 8		
	channel for					
CQI reporting				PUSCH	(Note 4)	
	Report Type			4	1	
	-pmi-				1	
	rationIndex per of HARQ					
	nissions				1	
		urts in an available i	inlink ren	orting ins	tance at	
subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)						
Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.						
Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.						
Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.						

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

#### 9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

			n		n	
Parameter		Unit	Test 1 Test		st 2	
	dwidth	MHz	10 MHz			
Transmis	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB			)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
	downlink guration				2	
	subframe guration			4	4	
	(Note 3)	dB	6	7	12	13
	$\hat{r}(j)$	dB[mW/15kHz]	-92	-91	-86	-85
	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-9	98
	ion channel			EP	A5	
Correla	ation and					
	onfiguration			High (		
	ing mode		PUCCH 1-0			
	g periodicity	ms	$N_{\rm pd} = 5$			
	delay	ms		10 c	or 11	
	channel for eporting		PUSCH (Note 4)			
	Report Type		4			
	-pmi-		3			
	rationIndex				, ,	
	per of HARQ				1	
	nissions K feedback					
				Multip	lexing	
	ode	l orts in an available u	unlink ron	orting inc	tanco at	
		n based on CQI es				ot lator
		, this reported wide				
		before SF#(n+4).		i ourniot i	oo appilo	a at the
Note 2:		easurement channel	RC.1 TE	DD accord	ding to Ta	able
		gory 2-8 with one s				
		ibed in Annex A.5.2				
Table A.4-1 for Category 1 with one/two sided dynamic OCNG						
Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.						
Note 3:		t, the minimum requirements shall be fulfilled for at the two SNR(s) and the respective wanted signal input				
level.						
Note 4: To avoid collisions between CQI reports and HARQ-ACK it is						
		report both on PUS				
		shall be transmitted				
	periodic CQI t	o multiplex with the	HARQ-A	CK on P	USCH in	uplink
subframe SF#7 and #2.						

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

Table 9.3.2.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

### 9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

#### 9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Parameter		Unit	Tes	Test 1 Test 2		
Band	width	MHz 10 MHz		10 MHz		
Transmiss	sion mode		9			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	$P_c$	dB		-	3	
	σ	dB		-	3	
SNR (1	Note 3)	dB	2	3	7	8
$\hat{I}_{a}^{0}$	(j) m	dB[mW/15kHz]	-96	-95	-91	-90
N	(j) oc	dB[mW/15kHz]	-9	98	-9	98
Propagatio	on channel			EP	A5	
Correlation and an				ULA Hig	h (4 x 2)	
Beamform	ning Model		As sp		Section	B.4.3
Cell-specific re				Antenna	ports 0,1	
CSI referen	nce signals		Antenna ports 15,,18			,18
	and subframe offset				/1	
	$\Delta_{CSI-RS}$			5	/1	
CSI-RS reference s	signal configuration		2			
CodeBookSubset	Restriction bitmap		0x0000 0000 0000 0001			001
Reportir	ng mode		PUCCH 1-1			
	periodicity	ms	$N_{\rm pd} = 5$			
CQI delay ms		8	3			
Physical channel for CQI/ PMI					(Note 4)	
	rting			PUSCH (Note 4)		
	Type for CQI/PMI				2	
	I for RI reporting			PUCCH	Format 2	
	ort type for RI				3	
	gurationIndex				2	
	ïgIndex				1	
	RQ transmissions				1	
Note 1: If the UE	reports in an availabl	e uplink reporting in	nstance a	t subfram	ne SF#n I	based
	stimation at a downlin				orted wid	leband
	not be applied at the e					
Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one					ne	
	sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.					
	<ul> <li>SNR(s) and the respective wanted signal input level.</li> <li>4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to</li> </ul>					
						y 10
	th on PUSCH instead					with the
	ed in downlink SF#1 a				nuitipiex	with the
HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.						

Table 9.3.2.2.1-1 Fading test for FDD

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

Table 9.3.2.2.1-2 Minimum requirement (FDD)

#### 9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Parameter		Unit	Tes	Test 1 Test 2		st 2	
	Bandwidth		MHz	10 MHz			
	Transmiss					9	
Uplir	nk downlin	k configuration				2	
Spec	ecial subframe configuration				4	4	
		$ ho_{\scriptscriptstyle A}$	dB	0			
Downlin		$ ho_{\scriptscriptstyle B}$	dB		(	0	
alloca	ation	$P_c$	dB		-	6	
		σ	dB		-	3	
	SNR (N	Note 3)	dB	1	2	7	8
	$\hat{I}_o^{(}$	j) r	dB[mW/15kHz]	-97	-96	-91	-90
	$N_{c}$	(j) 90	dB[mW/15kHz]	-9	8	-9	98
	Propagatic					PA5	
		enna configuration				h (8 x 2)	
	Beamform	0				n Section	
		nce signals				ports 0, 1	
		nce signals		An	tenna po	orts 15,	,22
CSI-RS p		and subframe offset $\Delta_{CSI-RS}$			5/	3	
CSI-RS r		signal configuration		2			
	CodeBookSubsetRestriction bitmap			0x0000 0000 0000 0020 0000 0000 0001			0000
	Reportir	eporting mode PUCCH 1-1 (Sub-mode: 2)			le: 2)		
	Reporting periodicity ms $N_{pd} = 5$						
CQI delay			ms		1	0	
Physical channel for CQI/ PMI reporting				PUSCH	(Note 4)		
PUCC		ype for CQI/ PMI			2	2c	
		I for RI reporting				Format 2	
		ort type for RI				3	
		gurationIndex				3	
	ri-Confi				805 (N	Vote 5)	
		RQ transmissions				1	
		edback mode				lexing	
Note 1:		reports in an availabl					
		stimation at a downlir				orted wic	leband
		ot be applied at the e					
Note 2:		e measurement chan					ne
Note 3:		namic OCNG Pattern test, the minimum re					the two
11018 0.		nd the respective wa					
Note 4:	To avoid	collisions between C	QI/ PMI reports and	HARQ-A			y to
	report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be						
	transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.						
Note 5:	RI reporting interval is set to the maximum allowable length of 160ms to minimise						
	collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and						
	HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe						
	SF#7 of the previous frame is applied in downlink subframes until a new CQI (after						
	CQI/PMI dropping) is available.						

Table 9.3.2.2.2-2 Minimum requirement (TDD
--------------------------------------------

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

# 9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

# 9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

#### 9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha$ % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

Para	meter	Unit	Test 1	Test 2
Band	dwidth	MHz	10 MHz	10 MHz
Transmission mode			1 (port 0)	1 (port 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	0	0
allocation	σ	dB	0	0
$I_{\scriptscriptstyle ot}^{(j)}$ for	RB 05	dB[mW/15kHz]	-102	-93
$I_{\scriptscriptstyle ot}^{(j)}$ for	RB 641	dB[mW/15kHz]	-93	-93
$I_{ot}^{(j)}$ for F	RB 4249	dB[mW/15kHz]	-93	-102
Î	r(j) or	dB[mW/15kHz]	-94 -94	
	Max number of HARQ transmissions		1	
			Clause B.2.4 wi	th $ au_d=0.45\mu\mathrm{s},$
Propagati	on channel		$a = 1, f_D = 5 \text{ Hz}$	
Reportin	ng interval	ms		-
	onfiguration		1:	x 2
	delay	ms		8
	ng mode			CH 3-0
	and size	RB	1	l size)
<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.3 FDD according to Table</li> </ul>			ilink subframe ideband CQI n+4) ding to Table	
A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.				P.1/2 FUD as

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

## 9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha$ % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

Para	meter	Unit	Test 1	Test 2
Bandwidth		MHz	10 MHz	10 MHz
Transmis	sion mode		1 (port 0)	1 (port 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	0	0
allocation	σ	dB	0	0
	downlink guration		2	
	subframe guration		4	
$I_{\scriptscriptstyle ot}^{(j)}$ for	RB 05	dB[mW/15kHz]	-102	-93
$I_{\mathit{ot}}^{(j)}$ for	RB 641	dB[mW/15kHz]	-93	-93
$I_{\mathit{ot}}^{(j)}$ for l	RB 4249	dB[mW/15kHz]	-93	-102
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-94	-94
	per of HARQ		1	
Propagat	ion channel		Clause B.2.4 with $\tau_d = 0.45 \mu$ $a = 1, f_D = 5 \text{ Hz}$	
Antenna c	onfiguration		1 x 2 5	
Reportir	ng interval	ms	5	
	delay	ms	10 o	
	ing mode		PUSC	H 3-0
	and size	RB	6 (full	size)
	K feedback ode		Multiplexing	
<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.</li> </ul>				

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

9.3.3.2 Void

9.3.3.2.1 Void

9.3.3.2.2 Void

# 9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

#### 9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{\text{PRB}}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Parameter		Unit	Tes	Test 1 Test 2		
Bandwidth		MHz		10 MHz		
Transmi	ssion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
SNR	(Note 3)	dB	9	10	14	15
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-89	-88	-84	-83
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-6	98
_			Clause	B.2.4 wit	th $ au_d = 0$	).45 <i>μ</i> s,
Propagation channel			$a = 1, f_D = 5 \text{ Hz}$			
Reporti	ng interval	ms	5			
	l delay	ms	8			
	ing mode		PUSCH 2-0			
	per of HARQ		1			
	missions					
	nd size ( <i>k</i> )	RBs		3 (full	size)	
	of preferred ands ( <i>M</i> )			Ę	5	
Note 1: Note 2: Note 3:	<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.5 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> </ul>			CQI able 0D as r at		

 Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

Table 9.3.4.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

#### 9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Parameter		Unit	Tes	st 1	Те	st 2
Bandwidth		MHz	10 MHz			
Transmi	ssion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
confi	downlink guration			2	2	
	subframe guration			2	1	
SNR	(Note 3)	dB	9	10	14	15
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-89	-88	-84	-83
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-6	98
			Clause B.2.4 with $\tau_d = 0.45 \mu s$			).45 <i>μ</i> s,
Propagation channel			u			
Reporti	ng interval	ms	$a = 1, f_D = 5 \text{ Hz}$			
	l delay	ms	10 or 11			
Report	ing mode			PUSC	H 2-0	
Max num	per of HARQ				1	
trans	missions					
	nd size ( <i>k</i> )	RBs		3 (full	size)	
	of preferred ands ( <i>M</i> )			Ę	5	
	CK feedback			Multip	lexina	
	node			•		
<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.5 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> </ul>						

#### Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

Table 9.3.4.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

#### 9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

#### 9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting

from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{\text{PRB}}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

BandwidthMHz10 MHzTransmission mode1 (port 0)Downlink power $\rho_A$ dB0allocation $\rho_B$ dB0solve (Note 3)dBdB0SNR (Note 3)dBdB0solve (Note 3)dB $\rho_B$ 0solve (Note 3)dB $\rho_B$ -89 $\rho_B$ dB[mW/15kHz]-90-89 $\rho_B$ dB[mW/15kHz]-98-98Propagation channelClause B.2.4 with $\tau_d = 0.45  \mu s$ , $a = 1, f_D = 5  Hz$ Reporting periodicitymsNb = 2CQI delayCQI delaymsPuCCH Report Type4for wideband CQI1PUCCH Report Type1for subband CQI1Max number of HARQ1transmissions1Subband size (k)RBsNote 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK in tis necessary to report both on PUSC	Para	ameter	Unit	Tes	st 1	Tes	st 2
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Bandwidth		MHz				
$\begin{array}{ c c c c c } \hline \begin{array}{ c c c } \hline \begin{array}{ c c c } \hline \begin{array}{ c c } \hline \end{array} \end{array}} \\ \hline \begin{array}{ c c } \hline \begin{array}{ c c } \hline \begin{array}{ c c } \hline \end{array} \end{array}} \\ \hline \begin{array}{ c c } \hline \begin{array}{ c c } \hline \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \\ \hline \begin{array}{ c c } \hline \begin{array}{ c c } \hline \begin{array}{ c } \hline \end{array} \end{array} \end{array} \end{array} \end{array} \\ \hline \begin{array}{ c c } \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \\ \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \\ \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \\ \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \end{array} \\ \hline \begin{array}{ c } \hline \begin{array}{ c } \hline \end{array} $	Transmi	ssion mode			1 (po	ort 0)	
allocation $ra$ dB0SNR (Note 3)dB891314 $\hat{f}_{or}^{(1)}$ dB[mW/15kHz]-90-89-85-84 $N_{oc}^{(j)}$ dB[mW/15kHz]-90-89-98-98Propagation channelClause B.2.4 with $\tau_d = 0.45  \mu s$ , $a = 1, f_D = 5  Hz$ Reporting periodicityms $N_P = 2$ CQI delayms $N_P = 2$ CQI delayPUSCH (Note 4)PUCCH Report Type41for subband CQI11Max number of HARQ1ransmissions1Subband Size (k)RBs6 (full size)Number of bandwidth3parts (J)1K1cqi-pmi-ConfigIndex1Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n-4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH 	Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
SNR (Note 3)dB891314 $\hat{I}_{or}^{(j)}$ dB[mW/15kHz]-90-89-85-84 $N_{oc}^{(j)}$ dB[mW/15kHz]-98-98-98Propagation channelClause B.2.4 with $\tau_d = 0.45  \mu s$ , $a = 1, f_D = 5  Hz$ Reporting periodicityms $N_P = 2$ CQI delayms891314Physical channel for CQI reportingPUSCH (Note 4)PUSCH (Note 4)PUCCH Report Type for wideband CQI14PUCCH Report Type for subband CQI11Max number of HARQ transmissions11Subband size (k)RBs6 (full size)Number of bandwidth parts (J)31K11cqi-pmi-ConfigIndex1Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downling ZBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent		$ ho_{\scriptscriptstyle B}$	dB		(	)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	allocation	σ	dB		(	)	
$N_{ac}^{(J)}$ dB[mW/15kHz]-98-98Propagation channelClause B.2.4 with $\tau_d = 0.45 \mu$ s, $a = 1, f_D = 5 \text{Hz}$ Reporting periodicityms $N_P = 2$ CQI delayms8Physical channel for CQI reportingPUSCH (Note 4)PUCCH Report Type4PUCCH Report Type1for wideband CQI1Max number of HARQ transissions1Subband size (k)RBsNumber of bandwidth parts (J)3K1cqi-pmi-ConfigIndex1Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.Note 5:CQI reports for the short subband CQI report for bandwidth part with j=1.Note 6:In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI	SNR	(Note 3)	dB	8	9	13	14
Propagation channelClause B.2.4 with $\tau_d = 0.45  \mu s$ , $a = 1, f_D = 5  \text{Hz}$ Reporting periodicityms $N_P = 2$ CQI delayms8Physical channel for CQI reportingPUSCH (Note 4)PUCCH Report Type4PUCCH Report Type1for wideband CQI1Max number of HARQ1transmissions1Subband size (k)RBsReporting for subband CQI3Number of bandwidth3parts (J)1Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH, PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.Note 5:CQI reports for the short subband CQI report for bandwidth part with j=1.Note 6:In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI		$\hat{f}_{or}^{(j)}$	dB[mW/15kHz]	-90	-89	-85	-84
Propagation channel $a = 1, f_D = 5 \text{ Hz}$ Reporting periodicityms $N_P = 2$ CQI delayms8Physical channel for CQI reportingPUSCH (Note 4)PUCCH Report Type4for wideband CQI1Max number of HARQ transmissions1Subband size (k)RBs6 (full size)Number of bandwidth parts (J)3K1cqi-pmi-ConfigIndex1Note 1:If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)Note 2:Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.Note 4:To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.Note 5:CQI reports for the short subband CQI report for bandwidth part) according to the most recent subband CQI report for bandwidth part with j=1.Note 6:In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI	1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-9	98
Physical channel for CQI reporting         PUSCH (Note 4)           PUCCH Report Type for wideband CQI         4           PUCCH Report Type for subband CQI         1           Max number of HARQ transmissions         1           Subband size (k)         RBs         6 (full size)           Number of bandwidth parts (J)         3           K         1           cqi-pmi-ConfigIndex         1           Note 1:         If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)           Note 2:         Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.           Note 3:         For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.           Note 4:         To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.           Note 5:         CQI reports for the short subband CQI report for bandwidth part with j=1.           Note 6:         In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband C	Propagat	ion channel		Clause			
Physical channel for CQI reporting         PUSCH (Note 4)           PUCCH Report Type for wideband CQI         4           PUCCH Report Type for subband CQI         1           Max number of HARQ transmissions         1           Subband size (k)         RBs         6 (full size)           Number of bandwidth parts (J)         3           K         1           cqi-pmi-ConfigIndex         1           Note 1:         If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)           Note 2:         Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.           Note 3:         For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.           Note 4:         To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.           Note 5:         CQI reports for the short subband CQI report for bandwidth part with j=1.           Note 6:         In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband C	Reporting	n periodicity	ms		No	= 2	
Physical channel for CQI reporting         PUSCH (Note 4)           PUCCH Report Type for wideband CQI         4           PUCCH Report Type for subband CQI         1           Max number of HARQ transmissions         1           Subband size (k)         RBs         6 (full size)           Number of bandwidth parts (J)         3           K         1           cqi-pmi-ConfigIndex         1           Note 1:         If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)           Note 2:         Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.           Note 3:         For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.           Note 4:         To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.           Note 5:         CQI reports for the short subband CQI report for bandwidth part with j=1.           Note 6:         In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband C					<u>۲۰۱</u> ۲	3	
CQI reporting       PUSCH (Note 4)         PUCCH Report Type for wideband CQI       4         PUCCH Report Type for subband CQI       1         Max number of HARQ transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI							
for wideband CQI       4         PUCCH Report Type for subband CQI       1         Max number of HARQ transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI					PUSCH	(Note 4)	
tor wideband CQI       1         PUCCH Report Type for subband CQI       1         Max number of HARQ transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI					,	1	
for subband CQI       1         Max number of HARQ transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI					-	+	
Max number of HARQ transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI				1			
transmissions       1         Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI							
Subband size (k)       RBs       6 (full size)         Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI				1			
Number of bandwidth parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI			PBe	6 (full size)			
parts (J)       3         K       1         cqi-pmi-ConfigIndex       1         Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         Note 4:       To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.         Note 5:       CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.         Note 6:       In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI			TLD3				
K         1           cqi-pmi-ConfigIndex         1           Note 1:         If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)           Note 2:         Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.           Note 3:         For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.           Note 4:         To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.           Note 5:         CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.           Note 6:         In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI				3			
<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	•			1			
<ul> <li>subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	cqi-pmi-	ConfigIndex		1			
<ul> <li>A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 1:	subframe SF# not later than cannot be app	#n based on CQI es SF#(n-4), this repor blied at the eNB dov	timation a ted subb vnlink be	at a down and or wi fore SF#(	llink subf ideband ( n+4)	CQI
<ul> <li>described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 2:						
<ul> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>			-	OCNG	Pattern C	P.1/2 FD	D as
<ul> <li>least one of the two SNR(s) and the respective wanted signal input level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 2			romonto	ahall ha f		r ot
<ul> <li>level.</li> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 5.						
<ul> <li>Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>				ne respe		iteu signe	arinput
<ul> <li>necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 4:		sions between CQI	reports a	nd HARG	ACK it i	s
<ul> <li>DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>							
<ul> <li>in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	DCI format 0						
<ul> <li>Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>					HARQ-A	CK on Pl	JSCH
<ul> <li>bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>							
<ul> <li>according to the most recent subband CQI report for bandwidth part with j=1.</li> <li>Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI</li> </ul>	Note 5:						
with j=1. Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI							dth nort
Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI			ne most recent SUDI		report	n banuwi	un pan
scheduled according to the most recently used subband CQI	Note 6:		here wideband COI	is reporte	ed, data i	s to be	
							I
			5	,	-		

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

Table 9.3.4.2.1-2 Minimum	requirement (	(FDD)	
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	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

#### 9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Para	ameter	Unit	Te	st 1	Tes	st 2
	dwidth	MHz		10	MHz	
Transmis	ssion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
Uplink	downlink			,	2	
	guration			4	<u>_</u>	
	subframe			4	1	
	guration (Note 3)	dB	8	9	13	14
		-				
	$\hat{f}^{(j)}_{or}$	dB[mW/15kHz]	-90	-89	-85	-84
Λ	$V_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-9	98
Propagat	ion channel		Clause	B.2.4 wit	th $ au_d=0$	.45 <i>μ</i> s,
				a = 1, f	$_{D} = 5 \text{ Hz}$	
	g periodicity	ms		<u></u> 10 c	= 5	
	delay channel for	ms				
	eporting			PUSCH	(Note 4)	
	Report Type			4	1	
	band CQI				•	
	Report Type band CQI		1			
	per of HARQ					
	nissions		1			
	nd size ( <i>k</i> )	RBs		6 (full	size)	
	of bandwidth rts ( <i>J</i> )			3	3	
pu	K				1	
cqi-pmi-(	ConfigIndex			3	3	
ACK/NAC	CK feedback			Multip	lexina	
		ute in the sub-state labels of	- Balana	-	-	
Note 1:	subframe SF# not later than cannot be app	orts in an available u fn based on CQI es SF#(n-4), this repor blied at the eNB dow	timation a ted subb vnlink be	at a down and or wi fore SF#(	ilink subfi ideband ( n+4).	CQI
Note 2:		easurement channel	00110			-
		e/two sided dynamic Annex A.5.2.1/2.	COUNG	Pattern C	P.1/2 TD	Das
Note 3:		the minimum requi	rements	shall be f	ulfilled for	r at
	least one of the	ne two SNR(s) and t	he respe	ctive war	nted signa	al input
Note 4:	To avoid collis necessary to DCI format 0	ollisions between CQI reports and HARQ-ACK it is to report both on PUSCH instead of PUCCH. PDCCH t 0 shall be transmitted in downlink SF#3 and #8 to allow QI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2			CCH c allow	
Note 5:	CQI reports for bandwidth paraccording to t with j=1.	or the short subband (having 2RBs in the last orthe short subband (having 2RBs in the last ort) are to be disregarded and data scheduling the most recent subband CQI report for bandwidth pa			dth part	
Note 6:		here wideband CQI cording to the most				I

# Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

#### Table 9.3.4.2.2-2 Minimum requirement (TDD)

# 9.3.5 Additional requirements for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

#### 9.3.5.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

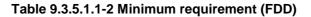
#### 9.3.5.1.1 FDD

For the parameters specified in Table 9.3.5.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Par	ameter	Unit	Cell 1	Cell 2
	ndwidth	MHz		MHz
Transmission mode		101112		ort 0)
Cyclic Prefix			Normal	Normal
	ell ID		0	1
	R (Note 8)	dB	-2	N/A
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
Propaga	tion channel		EPA5	Static (Note 7)
	lation and			
	configuration		Low (1 x 2)	(1 x 2)
DIP	(Note 4)	dB	N/A	-0.41
Ret	ference		Neta 0	N1/A
measure	ment channel		Note 2	N/A
Repor	ting mode		PUCCH 1-0	N/A
Reportin	g periodicity	ms	$N_{\rm pd} = 2$	N/A
CC	l delay	ms	8	N/A
	l channel for reporting		PUSCH (Note 3)	N/A
	Report Type		4	N/A
	qi-pmi-			
Configu	irationIndex		1	N/A
	ber of HARQ		1	N/A
Note 1:	missions	orts in an available	unlink reporting in	atanaa at
<ul> <li>subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to</li> </ul>				
<ul> <li>Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 4: The respective received power spectral density of each interfering</li> </ul>				
$\begin{array}{llllllllllllllllllllllllllllllllllll$				
Note 8: Note 9:	8.1.1. Downlink phys	NR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause .1. wnlink physical channel setup in Cell 2 applies OCNG pattern P.1 FDD as defined in Annex A.5.1.1.		

 Table 9.3.5.1.1-1 Fading test for single antenna (FDD)



γ	1.8	
UE Category	≥1	

#### 9.3.5.1.2 TDD

For the parameters specified in Table 9.3.5.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.1.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

				-
	ameter	Unit	Cell 1	Cell 2
	ndwidth	MHz		MHz
Transmission mode			1 (po	ort 0)
Uplink downlink				2
	iguration			_
	l subframe		2	4
	iguration			-
	lic Prefix		Normal	Normal
	cell ID		0	1
	R (Note 8)	dB	-2	N/A
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
	tion channel		EPA5	Static (Note 7)
	lation and		Low (1 x 2)	(1 x 2)
	configuration			
	(Note 4)	dB	N/A	-0.41
_	ference		Note 2	N/A
	ment channel			
	ting mode		PUCCH 1-0	N/A
· · · ·	ng periodicity	ms	$N_{\rm pd} = 5$	N/A
	l delay	ms	10 or 11	N/A
	I channel for		PUSCH (Note	N/A
	reporting		3)	
	Report Type		4	N/A
Configu	qi-pmi- ırationIndex		3	N/A
	ber of HARQ		1	N/A
	CK feedback			
	node		Multiplexing	N/A
Note 1: Note 2:	<ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not late than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.1 TDD according to Table</li> </ul>			link SF not later be applied at the ding to Table
Note 3:	necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink			
Note 4:	subframe SF#7 and #2. e 4: The respective received power spectral density of each interfering cell relative to $N_{oc}$ is defined by its associated DIP value as			
Note 5: Note 6: Note 7:	specified in clause B.5.1. Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded. Both cells are time-synchronous. Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.			
Note 8:	SINR corresp	onds to $ \widehat{E}_{s} ig / N_{oc}     $	of Cell 1 as define	d in clause
Note 9:	8.1.1. Downlink physical channel setup in Cell 2 applies OCNG pattern OP.1 TDD as defined in Annex A.5.2.1.			

Table 9.3.5.1.2-1 Fading test for single antenna	(חחד)
	(100)

Table 9.3.5.1.2-2	: Minimum re	equirement	(TDD)
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γ	1.8	
UE Category	≥1	

#### 9.3.5.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

#### 9.3.5.2.1 FDD

For the parameters specified in Table 9.3.5.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Parameter	Unit	Cell 1	Cell 2	
Bandwidth	MHz		MHz	
Transmission mode Cyclic Prefix		Normal	9 Normal	
Cyclic Prenx Cell ID		0	1	
SINR (Note 8)	dB	-2	N/A	
· · · · · · · · · · · · · · · · · · ·				
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A	
Propagation channel		EPA5	Static (Note 7)	
Correlation and antenna configuration		Low (2 x 2)	(1 x 2)	
DIP (Note 4)	dB	N/A	-0.41	
Cell-specific reference		Antenna ports	Antenna port 0	
signals		0,1		
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and subframe offset		5/1	N/A	
CSI-RS reference		2	NI/A	
signal configuration		2	N/A	
Zero-power CSI-RS				
configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	1 / 001000000000 000	
CodeBookSubsetRestr iction bitmap		001111	N/A	
Reference		Note 2	N/A	
measurement channel Reporting mode		PUCCH 1-1	N/A	
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	
CQI delay	ms	8	N/A	
Physical channel for		PUSCH (Note		
CQI/PMI reporting		3)	N/A	
PUCCH Report Type for CQI/PMI		2	N/A	
PUCCH channel for RI		PUCCH	N/A	
reporting PUCCH Report Type		Format 2		
for RI		3	N/A	
cqi-pmi-				
ConfigurationIndex		2	N/A	
ri-ConfigIndex		1	N/A	
Max number of HARQ				
transmissions		1	N/A	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)				
Note 2: Reference me A.4-1 with one	Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.			
Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.				
-	te 4: The respective received power spectral density of each interfering			
	cell relative to $N_{oc}$ is defined by its associated DIP value as			
Note 5: Two cells are 2 is the interfe	specified in clause B.5.1. Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.			
Note 6:         Both cells are time-synchronous.           Note 7:         Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.				

Table 9.3.5.2.1-1	Fading test for s	single antenna (FDD)

Note 8:	SINR corresponds to $\widehat{E}_s/N_{oc}$ ´ of Cell 1 as defined in clause
Note 9:	8.1.1. Downlink physical channel setup in Cell 2 applies OCNG pattern OP.1 FDD as defined in Annex A.5.1.1.

γ	1.8
UE Category	≥2

#### 9.3.5.2.2 TDD

For the parameters specified in Table 9.3.5.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Parameter	Unit			
Bandwidth	MHz	Cell 1 Cell 2		
Transmission mode		9		
Uplink downlink			-	
configuration			2	
Special subframe				
configuration		4	4	
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-2	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
Propagation channel		EPA5	Static (Note 7)	
Correlation and		Low (2 x 2)	(1 x 2)	
antenna configuration				
DIP (Note 4)	dB	N/A	-0.41	
Cell-specific reference		Antenna ports	Antenna port 0	
signals		0,1		
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and		5/3	N/A	
subframe offset		0,0		
CSI-RS reference		2	N/A	
signal configuration Zero-power CSI-RS				
configuration			3 /	
I <sub>CSI-RS</sub> /	Subframes /	N/A	00100000000	
ZeroPowerCSI-RS	bitmap	1 1/7 (	0000	
bitmap				
CodeBookSubsetRestr		001111	N1/A	
iction bitmap		001111	N/A	
Reference		Note 2	N/A	
measurement channel				
Reporting mode		PUCCH 1-1	N/A	
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	
CQI delay	ms	10	N/A	
Physical channel for		PUSCH (Note	N/A	
CQI/PMI reporting PUCCH Report Type		3)		
for CQI/PMI		2	N/A	
Physical channel for RI		PUCCH		
reporting		Format 2	N/A	
PUCCH Report Type			N1/A	
for RI		3	N/A	
cqi-pmi-		3	N/A	
ConfigurationIndex				
ri-ConfigIndex		805 (Note 9)	N/A	
Max number of HARQ		1	N/A	
transmissions ACK/NACK feedback		<u> </u>		
mode		Multiplexing	N/A	
	orts in an available i	ı Inlink reporting ins	tance at	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later.				
than SF#(n-4), this reported wideband CQI cannot be applied at the				
eNB downlink	eNB downlink before SF#(n+4)			
Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as				
			TDD as	
	described in Annex A.5.2.1.			
necessary to report both on PUSCH instead of PUCCH. PDCCH				
	DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow			
	periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.			
Note 4: The respective received power spectral density of each interfering				
cell relative to $N_{ac}$ is defined by its associated DIP value as				
	is defined by	no associated DI		

Note 5:	specified in clause B.5.1. Two cells are considered in which Cell 1 is the serving cell and Cell
1010 0.	2 is the interfering cell. Intefering cell is fully loaded.
Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to $ \widehat{E}_{s} \big/ {N_{oc}}^{ \prime}$ of Cell 1 as defined in clause
	8.1.1.
Note 9:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.
Note 10:	
	OP.1 TDD as defined in Annex A.5.2.1.



γ	1.8
UE Category	≥2

# 9.3.6 Minimum requirement (With multiple CSI processes)

The purpose of the test is to verify the reporting accuracy of the CQI and the UE processing capability for multiple CSI processes. Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.3.6-1. For UE supports one CSI process, CSI process 2 is configured and the corresponding requirements shall be fulfilled. For UE supports three CSI processes, CSI processes 0, 1 and 2 are configured and the corresponding requirements shall be fulfilled. For UE supports four CSI processes, CSI processes 0, 1, 2 and 3 are configured and the corresponding requirements shall be fulfilled.

Table 9.3.6-1	Configuration	of CSI	processes
---------------	---------------	--------	-----------

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 0	CSI-IM resource 1	CSI-IM resource 2

#### 9.3.6.1 FDD

For the parameters specified in Table 9.3.6.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.1-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Parameter		l lucit	Test 1				Test 2			
		Unit	TP1 TP2		22	TP1 TP2		P2		
Bandwidth		MHz	10 MHz		10 MHz					
Transmission mode			10 10		10 10		0			
	$ ho_{\scriptscriptstyle A}$	dB	0			0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		(	0				)	
allocation	$P_c$	dB	-3	-3 0		-3		0		
	σ	dB		-	3			-	3	
SNR (	Note 7)	dB	10	11	7	8	14	15	9	10
$\hat{I}_{a}$	(j) or	dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88
N	(j) oc	dB[mW/15kHz]		-6	98			-(	98	
Propagation channel			EPA 5 Low Clause B.2.4 with $\tau_d = 0.45 \mu s$ a = 1, $f_D = 5 \text{Hz}$		th .45 μs, : 1,	EPA 5 Low		Clause B.2.4.1 with $\tau_d = 0.45 \mu s$ , a = 1, $f_D = 5 \text{Hz}$		
Antenna co	onfiguration		4x	2	2		4	x2	2	x2
Beamform	ning Model				Section				n Section	
	between TPs	US			C				0	
	et between TPs	Hz			0				0	
	ference signals signal 0		Antenna Antenna ports 15,,18		ports 0,1 N/A		Antenna Antenna ports 15,,18		ſ	/A
	and subframe offset / $\Delta_{\rm CSI-RS}$		5/1		N/A		5/1		N	/A
CSI-RS 0 c	onfiguration		0		N/A		0		N	/A
CSI-RS	signal 1		N/A		Antenna ports 15,16		N/A			a ports ,16
	CSI-RS 1 periodicity and subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$		N/A		5/1		N/A		5	/1
	onfiguration		N//	4		5	N	N/A 5		
	RS 0 configuration erCSI-RS bitmap		N//		111000	/ 000000 00	N	/A	111000	/ 000000 00
	RS 1 configuration rerCSI-RS bitmap		1 / 001001 000	10000	N	/A	00100	/ 110000 000	N	/A
	and subframe offset / $\Delta_{CSI-RS}$		5/1		5/1		5	/1	5	/1
	onfiguration		2			2		2	2	2
	and subframe offset / $\Delta_{CSI-RS}$		5/*	1	N	/A	5	/1	N	/A
	onfiguration		6		N	/A	(	6	N	/A
T <sub>CSI-RS</sub>	CSI-IM 2 periodicity and subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$		N//	4	5/	/1	N	/A	5	/1
CSI-IM 2 c	onfiguration		N//						1	
	CSI-RS				RS 0		CSI-RS 0			
	CSI-IM Reporting mode			CSI-IM 0 PUCCH 1-1					I-IM 0	
	CodeBookSubsetR estriction bitmap		0x00	0x0000 0000 0000 0001		PUCCH 1-1 0x0000 0000 0000 000		001		
	Reporting periodicity	ms	N <sub>pd</sub> = 5		N <sub>pd</sub> = 5					
CSI process 0	CQI delay	ms	11		11					
	Physical channel for CQI/ PMI reporting		PUSCH (Note 6)		PUSCH (Note 6)					
	PUCCH Report Type for CQI/PMI				2		2			
	PUCCH channel		F	PUCCH	Format 2			PUCCH	Format 2	

[	for RI reporting						
	PUCCH report						
	type for RI		3	3	3	3	
	cqi-pmi- ConfigurationIndex		4	1	2	1	
	ri-ConfigIndex			2	2	2	
	CSI-RS		CSI-		CSI-RS 1		
	CSI-IM		CSI-		CSI-IM 0		
	Reporting mode		PUSC	CH 3-1	PUSCH 3-1		
CSI process 1	CodeBookSubsetR estriction bitmap		000001		000001		
	Reporting interval (Note 10)	ms	Ę	5	5		
	CQI delay	ms	1		11		
	Sub-band size	RB	6 (full		6 (full size)		
	CSI-RS		CSI-		CSI-		
	CSI-IM		CSI-		CSI-		
	Reporting mode		PUSC	CH 3-1	PUSC	:H 3-1	
CSI process 2 (For UE configured	CodeBookSubsetR estriction bitmap		0x0000 000	0 0000 0001	0x0000 0000	0 0000 0001	
single process)	Reporting interval (Note 8)	ms	Ę	5	5	5	
	CQI delay	ms	8	3	8	3	
	Sub-band size	RB	6 (full size	e) (Note 9)	6 (full size	e) (Note 9)	
	CSI-RS		CSI-	RS 0	CSI-	RS 0	
	CSI-IM		CSI-	IM 1	CSI-	IM 1	
	Reporting mode		PUSC	CH 3-1	PUSC	:H 3-1	
CSI process 2	CodeBookSubsetR		0.0000.000	0 0000 0001			
(For UE configured	estriction bitmap		0x0000 0000 0000 0001		0x0000 0000 0000 0001		
multiple processes)	Reporting interval (Note 10)	ms	5		5		
	CQI delay	ms	1	1	11		
	Sub-band size	RB	6 (full size) (Note 9)		6 (full size) (Note 9)		
	CSI-RS		CSI-RS 1		CSI-RS 1		
	CSI-IM		CSI-	IM 2	CSI-IM 2		
	Reporting mode		PUSC	CH 3-1	PUSCH 3-1		
CSI process 3	CodeBookSubsetR estriction bitmap		000001		000001		
	Reporting interval (Note 10	ms	5		5		
	CQI delay	ms	11		1	1	
	Sub-band size	RB	6 (full		6 (full size)		
CSI process for P	DSCH scheduling		CSI pro		CSI process 2		
	I ID		0	6	0	6	
	ated CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1	
	ocated CRS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2	
PMI for subframe	2, 3, 4, 7, 8 and 9		0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000	
PMI for subfi	rame 1 and 6		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000	
Max number of HA	RO transmissions		1	N/A	1	N/A	
	reports in an available	uplink reporting insta	Ince at subframe 9		) estimation at a		
	SF#(n-4), this reporte						
	allocated to PDCCH.						
	e measurement chann 8 and 9 from TP1.	el RC.12 FDD accord	ling to Table A.4-1	. PDSCH transmi	ssion is scheduled	d on subframe	
	NG as specified in A.5	5.1.8 is transmitted or	subframe 1 and 6	6 from TP1.			
	NG as specified in A.5				rom TP2		
Note 6: To avoid of	collisions between CQ OCI format 0 shall be tr	I/PMI reports and HA	RQ-ACK it is nece	essary to report bo	oth on PUSCH inst		
ACK on P	USCH in uplink SF#2 test, the minimum requ	and #7.		·			
signal inp	signal input level. Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic						
CQI/PMI/I	RI to be transmitted in sub-bands which are	uplink SF#0 and #5.				-	

Note 10: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#2 and #7 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#1 and #6.

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
α[%]	N/A	2	2	2
β[%]	N/A	40	40	40
$\delta$ [%]	10	N/A	N/A	N/A
γ	N/A	N/A	1.02	N/A
UE Category			≥1	

Table 9.3.6.1-2 Minimum requirement (FDD)

#### Table 9.3.6.1-3 Minimum median CQI difference between configured CSI processes (FDD)

	CSI process 1	CSI process 2	CSI process 3	
CSI process 0	N/A	1	3	
UE Category	≥1			

#### 9.3.6.2 TDD

For the parameters specified in Table 9.3.6.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.2-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Dava		11-14		Te	st 1			Te	st 2	
	meter	Unit	TF			P2	TP1 TP2			
	lwidth	MHz	ļ	10 MHz			10 MHz			
	sion mode		1		10		10			0
	nk configuration ne configuration		2 2 4 4		2 2 4 4					
		dB		-	0	+	<u> </u>		+	
	$ ho_{\scriptscriptstyle A}$				-			0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		C					0	
allocation	P <sub>c</sub>	dB	-:			0	-	3		C
	σ	dB			3				3	
	Note 7)	dB	10	11	7	8	14	15	9	10
	(j) or	dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88
N	oc (j)	dB[mW/15kHz]		-(	98			-(	98	
						B.2.4.1				B.2.4.1
						ith				ith
Propagati	on channel		EPA 5	5 Low		).45 <i>μ</i> s,	EPA	5 Low		).45 <i>μ</i> s,
						= 1,				= 1,
						= 5 Hz			2	= 5 Hz
	onfiguration		4>			x2		x2		x2
	ning Model		As sp		n Section	B.4.3	As sp		n Section	B.4.3
	between TPs et between TPs	us Hz			0 0				0 0	
	eference signals	112	Antenna ports 0,1		Antenna ports 0,1					
CSI-RS signal 0			Antenna ports 15,, 18 N/A			Antenr	a ports		/A	
CSI-RS 0 periodicity and subframe offset			5/		N	/A		/3	N	/A
$T_{\rm CSI-RS}$ / $\Delta_{\rm CSI-RS}$										
CSI-RS 0 configuration			(	)		/A	(	0		/A
	signal 1		N	Ά		na ports , 16	N	/A		a ports 16
	/ and subframe offset / $\Delta_{\rm CSI-RS}$		N	Ά	5	/3	N	/A	5	/3
	configuration		N/	Ά		5	N	/A		5
	RS 0 configuration /erCSI-RS bitmap		N	Ά	11100	3 / 000000 000	N	/A	11100	; / 000000 000
	RS 1 configuration /erCSI-RS bitmap		3 001001 000	10000	N	/A	00100	; / 110000 200	N	/A
	and subframe offset / $\Delta_{\text{CSI-RS}}$		5/	3	5	/3	5	/3	5	/3
CSI-IM 0 c	onfiguration		2	2		2		2		2
CSI-IM 1 periodicity	and subframe offset / $\Delta_{CSI-RS}$		5/	3	N	/A	5	/3	N	/A
	onfiguration		e	6	N	/A	(	3	N	/A
	and subframe offset		N		1	/3		/A		/3
T <sub>CSI-RS</sub>	/ Δ <sub>CSI-RS</sub>									
CSI-IM 2 c	onfiguration		N/			1	N	/A		1
	CSI-RS CSI-IM				RS 0 -IM 0				RS 0 -IM 0	
	Reporting mode				-IIVI 0 CH 1-1					
	CodeBookSubsetR estriction bitmap		0x0		0 0000 0	001	PUCCH 0x0000 0000 (			001
CSI process 0	Reporting periodicity	ms	N <sub>pd</sub> = 5			N <sub>pd</sub> = 5				
	CQI delay	ms		1	2		12		2	
	Physical channel for CQI/ PMI reporting			PUSCH	(Note 6)		PUSCH (Note 6)			
	PUCCH Report		2			2				

# Table 9.3.6.2-1 Fading test for TDD

		Type for CQI/PMI					
		PUCCH channel					
		for RI reporting		PUCCH	Format 2	PUCCH	Format 2
		PUCCH report			3		3
		type for RI		,			
		cqi-pmi- ConfigurationIndex		:	3	:	3
		ri-ConfigIndex		805 (N	ote 10)	805 (N	ote 10)
		CSI-RS			RS 1		RS 1
		CSI-IM			-IM 0		·IM 0
		Reporting mode		PUSC	CH 3-1	PUSC	CH 3-1
		CodeBookSubsetR		000	001	000	001
CSI pro	ocess 1	estriction bitmap		000	001	000	001
		Reporting interval (Note 9)	ms		5		5
		CQI delay	ms	1	2	1	2
		Sub-band size	RB	6 (ful		6 (ful	
		CSI-RS			RS 0		RS 0
		CSI-IM			-IM 1	CSI-	
		Reporting mode			CH 3-1	PUSC	
		CodeBookSubsetR		0,0000,000	0 0000 0001	0,0000,000	0 0000 0001
CSI pro	ocess 2	estriction bitmap		000000000	0 0000 0001	0x0000 000	0 0000 000 1
		Reporting interval	ms		5		5
		(Note 9) CQI delay	ms	1	2	1	2
		Sub-band size	RB		e) (Note 8)	-	e) (Note 8)
		CSI-RS		CSI-	RS 1	CSI-	
		CSI-IM			·IM 2	CSI-IM 2	
		Reporting mode		PUSCH 3-1		PUSCH 3-1	
		CodeBookSubsetR				000001	
CSI pro	ocess 3	estriction bitmap		000001			
		Reporting interval	ms		5	Į	5
		(Note 9) CQI delay		1	2	1	2
		Sub-band size	ms RB	6 (ful		6 (ful	
CSI pro	ocess for P	DSCH scheduling			ocess 2		DCess 2
00. p. (		II ID		0	6	0	6
Q	uasi-co-loc	ated CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
(	Quasi-co-lo	ocated CRS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2
D	MI for subf	rame 4and 9		0x0000 0000	100000	0x0000 0000	100000
F				0000 0001	100000	0000 0001	100000
PI	MI for subfi	rame 3 and 8		0x0000 0000	100000	0x0000 0000	100000
				0001 0000		0001 0000	
		RQ transmissions		Multiplexing	N/A N/A	1 Multiploving	N/A N/A
Note 1:		eedback mode reports in an available	unlink reporting insta			Multiplexing	
Note 1.		SF#(n-4), this reported					
Noto 2:		allocated to PDCCH.		ior be applied at ti		f(11+4).	
Note 2:		e measurement channe		ling to Toble A 4 4		anian in anhadula	d on oubfrom a 1
Note 3:	and 9 fror			Ing to Table A.4-1			
Note 4:		NG is transmitted as s	pecified in A.5.2.8 or	subframe 3 and 8	3 from TP1.		
Note 5:		NG is transmitted as s					
Note 6:	To avoid of	collisions between CQI	PMI reports and HA	RQ-ACK it is nece	essary to report bo		
		OCI format 0 shall be tr		< SF#3 and #8 to a	allow periodic CQ	I/PIMI to multiplex	with the HARQ-
Noto 7		USCH in uplink SF#7 test, the minimum requ		filled for at least o	ne of the two SNE	(c) and the reco	ctive wanted
Note 7:	signal inp			inieu iui al least 0		(a) and the respe	CIVE WAILED
Note 8:		OCI format 0 with a trig	ger for aperiodic COI	shall be transmitt	ed in downlink SF	#3 and #8 to allow	v aperiodic
		RI to be transmitted in					- F
Note 9:		sub-bands which are i		CH transmission.	TM10 OCNG shou	uld be transmitted	
Note 10:	RI reporti	ng interval is set to the	maximum allowable	length of 160ms t	o minimise collisio	ons between RI, C	QI/PMI and
1	HARQ-AC	CK reports. In the case	when all three report	ts collide, it is exp	ected that CQI/PM	Il reports will be d	ropped, while RI
	and HAR	Q-ACK will be multiple:	ked. At eNB, CQI rep	ort collection shal	I be skipped every	160ms during pe	rformance

and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
α[%]	N/A	2	2	2
β[%]	N/A	40	40	40
$\delta$ [%]	10	N/A	N/A	N/A
γ	N/A	N/A	1.02	N/A
UE Category	<u>`</u> ≥1			

Table 9.3.6.2-2 Minimum requirement (TDD)

Table 9.3.6.2-3 Minimum median CQI difference between configured CSI processes (TDD)

	CSI process 1	CSI process 2	CSI process 3
CSI process 0	N/A	1	3
UE Category		≥1	

# 9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6 with 1 TX and transmission mode 9 with 4 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}} \, .$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{follow1,follow2}$  is 70% of the maximum throughput obtained at  $SNR_{follow1,follow2}$  using the precoders configured according to the UE reports, and  $t_{rnd1, rnd2}$  is the throughput measured at  $SNR_{follow1, follow2}$  with random precoding.

# 9.4.1 Single PMI

# 9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

#### 9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

Para	meter	Unit	Test 1	
Ban	dwidth	MHz	10	
Transmis	sion mode		6	
Propagat	on channel		EVA5	
Precoding	granularity	PRB	50	
	ation and onfiguration		Low 2 x 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	
power	$ ho_{\scriptscriptstyle B}$	dB	-3	
allocation	σ	dB	0	
Ν	$V_{oc}^{(j)}$	dB[mW/15kHz]	-98	
Report	ng mode		PUSCH 3-1	
Reporting interval		ms	1	
PMI dela	ay (Note 2)	ms	8	
Measurement channel			R. 10 FDD	
	Pattern		OP.1 FDD	
	er of HARQ		4	
	ncy version sequence		{0,1,2,3}	
Note 1: For random precoder selection, the precoder				
Note 2:	shall be updated in each TTI (1 ms granularity). If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n- 4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).			

Table 9.4.1.1.1-1 PMI test for single-layer (FDD)

Table 9.4.1.1.1-2 Minimum	requirement (FDD)
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Parameter	Test 1
γ	1.1
UE Category	≥1

# 9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

Para	meter	Unit	Test 1	
Banc	lwidth	MHz	10	
Transmission mode			6	
Uplink downlink			4	
config	uration		1	
	subframe		4	
	uration			
	on channel		EVA5	
	granularity	PRB	50	
	tion and		Low 2 x 2	
antenna co	onfiguration		LOW Z X Z	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	
power	$ ho_{\scriptscriptstyle B}$	dB	-3	
allocation	σ	dB	0	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	
Reporting mode			PUSCH 3-1	
Reporting interval		ms	1	
	y (Note 2)	ms	10 or 11	
	ent channel		R.10 TDD	
	Pattern		OP.1 TDD	
	er of HARQ		4	
	nissions			
	ncy version		{0,1,2,3}	
	equence		(0,1,2,0)	
	K feedback		Multiplexing	
	ode			
5	shall be updat	recoder selection, the ted in each available		
	transmission instance.			
		orts in an available u		
-		brame SF#n based	<b>•</b> ····	
		a downlink SF not la	•	
		ed PMI cannot be ap	oplied at the	
eNB downlink before SF#(n+4).				

Table 9.4.1.1.2-1 PMI test for single-layer (TDD)

Parameter	Test 1
γ	1.1
UE Category	≥1

# 9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

# 9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

-					
Parameter		Unit	Test 1		
	dwidth	MHz	10		
Transmission mode			6		
	on channel		EVA5		
	ation and		Low 4 x 2		
antenna c	onfiguration		2011 1 1 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6		
power	$ ho_{\scriptscriptstyle B}$	dB	-6		
allocation	σ	dB	3		
Λ	$I_{oc}^{(j)}$	dB[mW/15kHz]	-98		
PMI	delay	ms	8 or 9		
	ng mode		PUCCH 2-1 (Note 6)		
	periodicity	ms	$N_{\rm pd} = 2$		
	channel for		'		
CQI re	eporting		PUSCH (Note 3)		
	Report Type nd CQI/PMI		2		
	Report Type band CQI		1		
Measurement channel			R.14-1 FDD		
	Pattern		OP.1/2 FDD		
Precoding granularity		PRB	6 (full size)		
Number of bandwidth					
parts ( <i>J</i> )			3		
K			1		
cqi-pmi-ConfigIndex			1		
Max number of HARQ			4		
	nissions		т		
	ncy version		{0,1,2,3}		
	sequence				
		recoder selection, th (2 ms granularity).	ne precoder shall be updated		
			plink reporting instance at		
			imation at a downlink SF not later		
	than SF#(n-4)	, this reported PMI	cannot be applied at the eNB		
	downlink befo	ore SF#(n+4).			
			Q-ACK and wideband CQI/PMI or		
			eport both on PUSCH instead of		
			nall be transmitted in downlink		
			odic CQI to multiplex with the		
			subframe SF#5, #7, #1 and #3.		
	Note 4: Reports for the short subband (having 2RBs in the last bandwidth				
	part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.				
		nere wideband Pivil	is reported, data is to be		
			in DCI format 1B shall be mapped		
			indicate the codebook index used		
			[4] according to the latest PMI		
	report on PUC				

Table 9.4.1.2.1-1	PMI test for sing	gle-layer (FDD)	
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Table 9.4.1.2.1-2 Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	≥1

# 9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

	Parameter Unit Test 1				
Bandwidth MHz 10			-		
	Transmission mode 6				
	Uplink downlink 1				
Special	Special subframe 4				
	ion channel		EVA5		
	ation and		EVAS		
	configuration		Low 4 x 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6		
power	$ ho_{\scriptscriptstyle B}$	dB	-6		
allocation	σ	dB	3		
Ι	$V_{oc}^{(j)}$	dB[mW/15kHz]	-98		
	l delay	ms	10		
	ing mode		PUCCH 2-1 (Note 6)		
	g periodicity	ms	$N_{\rm P}=5$		
Physical	channel for eporting		PUSCH (Note 3)		
	Report Type				
for wideba	and CQI/PMI		2		
	PUCCH Report Type				
for subband CQI					
Measurement channel R.14-1 TDD					
OCNG PatternOP.1/2 TDDPrecoding granularityPRB6 (full size)					
		PRB	6 (full size)		
	of bandwidth		3		
pa	rts ( <i>J</i> ) K		1		
cai-pmi-l	ConfigIndex		4		
	per of HARQ		т		
transmissions 4					
Redundancy version					
coding sequence {0,1,2,3}					
ACK/NACK fedback Multiplexing					
Note 1: For random precoder selection, the precoder shall be updated in					
each available downlink transmission instance.					
Note 2:					
	subrame SF#n based on PMI estimation at a downlink SF not later				
than SF#(n-4), this reported PMI cannot be applied at the eNB					
	downlink before SF#(n+4).				
Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI o subband CQI it is necessary to report both on PUSCH instead of					
PUCCH. PDCCH DCI format 0 shall be transmitted in downlink					
	SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-AC on PUSCH in uplink subframe SF#8 and #3.				
Note 1.	Note 4: Reports for the short subband (having 2RBs in the last bandwidth				
11010 4.	part) are to be disregarded and instead data is to be transmitted on				
	the most recently used subband for bandwidth part with j=1.				
Note 5:					
	transmitted on the most recently used subband.				
Note 6:			in DCI format 1B shall be mapped		
	to "0" and TPI	<b>MI</b> information shall	indicate the codebook index used		
	in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI				
	report on PUCCH.				

## Table 9.4.1.2.2-1 PMI test for single-layer (TDD)

Table 9.4.1.2.2-2 Minimum	requirement	(TDD)
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	Test 1
γ	1.2
UE Category	≥1

# 9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

## 9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

ParameterUnitTest 1BandwidthMHz10Transmission mode9Propagation channelEPA5Precoding granularityPRB50Correlation andLowantenna configurationULA 4 x 2Cell-specific referenceAntenna portssignals0,1CSI reference signalsAntenna ports15,,1815,,18Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset5/ 1TCSI-RS / $\Delta$ CSI-RS0x0000 0000CodeBookSubsetRestriction bitmap0x0000 0000OcodeBookSubsetRestriction bitmap0x0000 0000Downlink power allocation $\rho_B$ dBOwnlink power allocation $\rho_B$ dBOcold B-3 $\sigma$ dBReporting modelPUSCH 3-1Reporting modePUSCH 3-1Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Max number of HARQ transmissions4Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).Note 2:If the UE reports in an available uplink reporting				
$\begin{tabular}{ c c c c c c } \hline Transmission mode & 9 \\ \hline Propagation channel & EPA5 \\ \hline Precoding granularity & PRB & 50 \\ \hline Correlation and & Low \\ antenna configuration & ULA 4 x 2 \\ \hline Cell-specific reference & Antenna ports \\ signals & 0,1 \\ \hline CSI reference signals & Antenna ports \\ 15,,18 \\ \hline Beamforming model & Annex B.4.3 \\ \hline CSI-RS periodicity and \\ subframe offset & 5/1 \\ \hline $T_{CSI-RS} / \Delta_{CSI-RS} & 0 \\ \hline CodeBookSubsetRestr & 0x0000 0000 \\ \hline $Pc$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $N_{oc}^{(j)}$ & dB[mW/15kHz] & -98 \\ \hline $Reporting mode & PUSCH 3-1 \\ \hline $Reporting interval $ms$ & 5 \\ \hline $PMI delay (Note 2) $ms$ & 8 \\ \hline $Measurement channel $R.44 FDD \\ \hline $OCNG Pattern $OP.1 FDD \\ \hline $Max number of HARQ $transmissions $transmissio$	Parameter		Unit	Test 1
$\begin{tabular}{ c c c c c } \hline Propagation channel & EPA5 \\ \hline Precoding granularity & PRB & 50 \\ \hline Correlation and & Low \\ antenna configuration & ULA 4 x 2 \\ \hline Cell-specific reference & Antenna ports \\ signals & 0,1 \\ \hline CSI reference signals & Antenna ports \\ 15,,18 \\ \hline Beamforming model & Annex B.4.3 \\ \hline CSI-RS periodicity and \\ subframe offset & 5/ 1 \\ \hline $T_{CSI-RS} / $\Delta_{CSI-RS} & $-5/ 1$ \\ \hline $T_{CSI-RS} / $\Delta_{CSI-RS} & $-5/ 1$ \\ \hline $CodeBookSubsetRestr & $0x0000 0000 \\ iction bitmap & $0000 FFFF$ \\ \hline $Pc$ & dB & $-3$ \\ \hline $Pmindem dB & $-3$ \\ \hline $Pc$ & dB & $-3$ \\ \hline $Pmindem dB & $0$ \\ \hline $Pc$ & dB & $-3$ \\ \hline $Pmindem dB & $0$ \\ \hline $Pc$ & dB & $-3$ \\ \hline $Pmindem dB & $0$ \\ \hline $Pc$ & dB & $-3$ \\ \hline $Pmindem dB & $			MHz	
$\begin{tabular}{ c c c c c } \hline Precoding granularity & PRB & 50 \\ \hline Correlation and & Low \\ antenna configuration & ULA 4 x 2 \\ \hline Cell-specific reference \\ signals & 0,1 \\ \hline CSI reference signals & 0,1 \\ \hline CSI-RS periodicity and \\ subframe offset & 5/1 \\ \hline $T_{CSI-RS} / \Delta_{CSI-RS} \\ \hline CSI-RS reference \\ signal configuration & 6 \\ \hline CodeBookSubsetRestr & 0x0000 0000 \\ \hline ction bitmap & 0000 FFFF \\ \hline \hline $Pc$ & dB & 0 \\ \hline $Pc$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $N_{oc}^{(j)}$ & dB[mW/15kHz] & -98 \\ \hline $Reporting mode $ $PUSCH 3-1 $ \\ \hline $Reporting interval $ $ms$ $ $5 $ \\ \hline $PMI delay (Note 2) $ $ms$ $ $8 $ \\ \hline $Measurement channel $ $ $R.44 FDD $ \\ \hline $OCNG Pattern $ $ $ $ $OP.1 FDD $ \\ \hline $Max number of HARQ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $$				
$\begin{tabular}{ c c c c c c } \hline Correlation and antenna configuration & ULA 4 x 2 \\ \hline Cell-specific reference signals & 0,1 \\ \hline CSI reference signals & 15,,18 \\ \hline Beamforming model & Annex B.4.3 \\ \hline CSI-RS periodicity and subframe offset & 5/1 \\ \hline $T_{CSI-RS} / $\Delta_{CSI-RS} & 5/1 \\ \hline $T_{CSI-RS} / $\Delta_{CSI-RS} & 6 \\ \hline CodeBookSubsetRestr & 0x0000 0000 \\ iction bitmap & 0000 FFFF \\ \hline $Pc$ & dB & 0 \\ \hline $Pc$ & dB & 0 \\ \hline $Pc$ & dB & -3 \\ \hline $\sigma$ & dB & -3 \\ \hline $Reporting mode & PUSCH 3-1 \\ \hline $Reporting interval & ms & 5 \\ \hline $PMI delay (Note 2) & ms & 8 \\ \hline $Measurement channel & R.44 FDD \\ \hline $OCNG Pattern & OP.1 FDD \\ \hline $Max number of HARQ \\ $transmissions & 4 \\ \hline $Redundancy version \\ $coding sequence & $coder selection, the precoder \\ $shall be updated in each TTI (1 ms granularity). \\ \hline \end{tabular}$				
antenna configurationULA 4 x 2Cell-specific reference signalsAntenna ports 0,1CSI reference signalsAntenna ports 15,,18Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ $5/1$ CSI-RS reference signal configuration6CodeBookSubsetRestr allocation $0x0000\ 0000$ $\rho_A$ dB $0$ Downlink power allocation $\rho_B$ dB $\rho_{\alpha}$ dB $0$ $\sigma$ dB $-3$ $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting interval ms $5$ PMI delay (Note 2)ms $8$ Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions $4$ Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).			PRB	
Cell-specific reference signalsAntenna ports $0,1$ CSI reference signalsAntenna ports $15,,18$ Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ $5/1$ CSI-RS reference signal configuration $6$ CodeBookSubsetRestr iction bitmap $0x0000 0000$ $\rho_A$ $dB$ $\rho_A$ $dB$ $0$ Downlink power allocation $\rho_B$ $dB$ $\rho_{\alpha c}$ $dB$ $-3$ $N_{oc}^{(j)}$ $dB[mW/15kHz]$ $-98$ Reporting modePUSCH 3-1Reporting intervalms $5$ PMI delay (Note 2)ms $8$ Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions $4$ Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
signals0,1CSI reference signalsAntenna ports $15,,18$ Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ $5/1$ CSI-RS reference signal configuration6CodeBookSubsetRestr iction bitmap $0x0000 0000$ $0000 FFFF\rho_AdB0Downlinkpowerallocation\rho_BdB\sigmadB-3\sigmadB-3N_{oc}^{(j)}dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQtransmissions4Redundancy versioncoding sequence\{0,1,2,3\}Note 1:For random precoder selection, the precodershall be updated in each TTI (1 ms granularity).$	Coll oppoit	antenna configuration ULA 4 x 2		
CSI reference signalsAntenna ports $15,,18$ Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ $5/1$ CSI-RS reference signal configuration $6$ CodeBookSubsetRestr iction bitmap $0x0000 0000$ Downlink power allocation $\rho_A$ $dB$ $0$ $\rho_A$ $dB$ $0$ $\rho_{C}$ $dB$ $-3$ $\sigma$ $dB$ $-3$ $\sigma$ $dB$ $-3$ $Reporting mode$ PUSCH 3-1Reporting intervalms $5$ PMI delay (Note 2)ms $8$ Measurement channelR.444 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions $4$ Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
CSI reference signals15,,18Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset5/ 1 $T_{CSI-RS} / \Delta_{CSI-RS}$ 5/ 1CSI-RS reference signal configuration6CodeBookSubsetRestr0x0000 0000iction bitmap0000 FFFF $\rho_A$ dB0Downlink power allocation $\rho_B$ dB $\rho_a$ dB-3 $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
Beamforming modelAnnex B.4.3CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ $5/1$ CSI-RS reference signal configuration $6$ CodeBookSubsetRestr $0x0000 0000$ iction bitmap $0000$ FFFF $\rho_A$ dB $0$ Downlink power allocation $\rho_B$ dB $\rho_C$ dB $-3$ $\sigma$ dB $-3$ $N_{oc}^{(j)}$ dB[mW/15kHz] $-98$ Reporting modePUSCH 3-1Reporting intervalms $5$ PMI delay (Note 2)ms $8$ Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions $4$ Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	CSI refere	ence signals		
CSI-RS periodicity and subframe offset $5/1$ $T_{CSI-RS} / \Delta_{CSI-RS}$ 6CSI-RS reference signal configuration6CodeBookSubsetRestr0x0000 0000 0000 FFFF $\rho_A$ dB0Downlink power allocation $\rho_B$ dB $Downlinkpowerallocation\rho_BdBDownlinkpowerallocation\rho_CdB\sigmadB-3\sigmadB-3N_{oc}^{(j)}dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQtransmissions4Redundancy versioncoding sequence\{0,1,2,3\}Note 1:For random precoder selection, the precodershall be updated in each TTI (1 ms granularity).$	Beamforr	ning model		Annex B.4.3
subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$ 5/ 1CSI-RS reference signal configuration6CodeBookSubsetRestr iction bitmap0x0000 0000 0000 FFFF $\rho_A$ dB0Downlink power allocation $\rho_B$ dBDownlink power allocation $\rho_C$ dB $Pc$ dB-3 $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	CSI-RS pe	riodicity and		
$\begin{array}{c c} \text{CSI-RS reference} & 6 \\ \hline \text{signal configuration} & 0 \\ \hline \text{CodeBookSubsetRestr} & 0 \\ \hline \text{codeBookSubsetRestr} & 0 \\ \hline \text{iction bitmap} & 0 \\ \hline \text{O000 FFFF} \\ \hline \\ $	subfrar	ne offset		5/ 1
signal configuration6CodeBookSubsetRestr0x0000 0000iction bitmap0000 FFFF $\rho_A$ dB0Downlink $\rho_B$ dBpowerPcdBallocationPcdB $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	T <sub>CSI-RS</sub>	/ $\Delta_{CSI-RS}$		
signal configuration $0$ CodeBookSubsetRestr $0x0000\ 0000\ 0000\ FFFF$ iction bitmap $0$ Downlink $\rho_A$ dBpower $AB$ $0$ allocation $Pc$ dB $\sigma$ dB $-3$ $\sigma$ dB $-3$ $N_{oc}^{(j)}$ dB[mW/15kHz] $-98$ Reporting modePUSCH 3-1Reporting intervalms $5$ PMI delay (Note 2)ms $8$ Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions $4$ Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				6
iction bitmap0000 FFFFDownlink power allocation $\rho_A$ dB0 $\rho_B$ dB0 $\sigma$ dB-3 $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	signal co	nfiguration		-
$\rho_A$ dB0Downlink power allocation $\rho_B$ dB0 $Pc$ dB-3 $\sigma$ dB-3 $\sigma$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
$\begin{array}{ c c c c } \hline PA & PA$	iction bitmap			0000 FFFF
power allocation $P_B$ dB0PcdB-3 $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).		$ ho_{\scriptscriptstyle A}$	dB	0
allocationPcdB-3 $\sigma$ dB-3 $N_{oc}^{(j)}$ dB[mW/15kHz]-98Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence $\{0,1,2,3\}$ Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	-	$ ho_{\scriptscriptstyle B}$	dB	0
Noc       dB[mW/15kHz]       -98         Reporting mode       PUSCH 3-1         Reporting interval       ms       5         PMI delay (Note 2)       ms       8         Measurement channel       R.44 FDD         OCNG Pattern       OP.1 FDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).		Pc	dB	-3
Reporting modePUSCH 3-1Reporting intervalms5PMI delay (Note 2)ms8Measurement channelR.44 FDDOCNG PatternOP.1 FDDMax number of HARQ transmissions4Redundancy version coding sequence{0,1,2,3}Note 1:For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	σ dB -3		-3	
Reporting interval       ms       5         PMI delay (Note 2)       ms       8         Measurement channel       R.44 FDD         OCNG Pattern       OP.1 FDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	$N_{oc}^{(j)}$ dB[mW/15kHz] -98			
Reporting interval       ms       5         PMI delay (Note 2)       ms       8         Measurement channel       R.44 FDD         OCNG Pattern       OP.1 FDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).			PUSCH 3-1	
PMI delay (Note 2)       ms       8         Measurement channel       R.44 FDD         OCNG Pattern       OP.1 FDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).			5	
OCNG Pattern       OP.1 FDD         Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	PMI delay (Note 2) ms 8		8	
Max number of HARQ transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	Measurement channel R.44 FDD			
transmissions       4         Redundancy version coding sequence       {0,1,2,3}         Note 1:       For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).			OP.1 FDD	
transmissions       Image: Constraint of the preceder selection and the preceder selection and the preceder shall be updated in each TTI (1 ms granularity).	Max number of HARQ			4
coding sequence     {0, 1, 2, 3}       Note 1:     For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).	transmissions			
Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
shall be updated in each TTI (1 ms granularity).	coding sequence			
	shall be undated in each TTI (1 ms grapularity)			ne precoder
instance at subrame SF#n based on PMI				
estimation at a downlink SF not later than SF#(n-				
	4), this reported PMI cannot be applied at the			
eNB downlink before SF#(n+4).				
Note 3: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order	Note 3: PDSCH _RA= 0 dB,		= 0 dB, PDSCH_RB	
to have the same PDSCH and OCNG power per	to have the same PDSCH and C			CNG power per
subcarrier at the receiver.				

#### Table 9.4.1.3.1-1 PMI test for single-layer (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

Table 9.4.1.3.1-2 Minimum requirement (FDD)

#### 9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

Parameter Linit Tost 1			
Parameter Bandwidth		Unit MHz	<b>Test 1</b> 10
Bandwidth Transmission mode		IVIEZ	9
Uplink downlink			
configuration			1
Special s			4
configuration			4
Propagation channel			EVA5
	granularity	PRB	50
Antenna co	onfiguration		8 x 2
Correlation modeling			High, Cross polarized
Cell-specifi sigr			Antenna ports 0,1
CSI referer	nce signals		Antenna ports 15,,22
Beamform	ing model		Annex B.4.3
CSI-RS per			7111107 0.4.0
subfram			5/4
T <sub>CSI-RS</sub> /	$\Delta$ CSI-RS		
CSI-RS r			0
signal cor	figuration		-
CodeBookS	SubsetRestr		0x0000 0000 001F FFE0
iction b			0000 0000
			FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-6
σ dB		-3	
N <sub>oc</sub> <sup>(j)</sup> dB[mW/15kHz] -98		-98	
Reporting mode PUSCH 3-1		PUSCH 3-1	
Reporting interval ms 5			
PMI delay (Note 2) ms 10			
UE Category		for UE Category 1, R.45 TDD for UE Category	
OCNG Pattern		≥2 OP.1 TDD	
Max number of HARO			
transmissions 4		4	
Redundancy version {0,1,2,3}			
coding s	coding sequence		
	ACK/NACK feedback mode Multiplexin		Multiplexing
		recoder selection, th	ne precoder
S Note 2: If ir	shall be updated in each TTI (1 ms granularity). If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-		
e Note 3: F C	4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on unlink SF#2 and #9		
Note 4: F	on uplink SF#3 and #8. te 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4		

Table 9.4.1.3.2-1 PMI test for single-layer (TDD)

Parameter	Test 1
γ	3
UE Category	≥1

# 9.4.1a Void

- 9.4.1a.1 Void
- 9.4.1a.1.1 Void
- 9.4.1a.1.2 Void
- 9.4.2 Multiple PMI

# 9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

Parameter Unit Test 1			Test 1
Bandwidth MHz		10	
Transmis	sion mode		6
Propagatio	on channel		EPA5
(only for re followir	granularity porting and ng PMI)	PRB	6
	tion and		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
	N <sub>oc</sub> <sup>(j)</sup> dB[mW/15kHz] -98		
Reporting mode PUSCH 1-2			PUSCH 1-2
Reporting interval ms 1			
PMI delay ms 8 R.11-3 FDD			
Measurem	Measurement channel for UE Measurement channel for UE R.11 FDD for UE Category ≥2		
OCNG Pattern OP.1/2 FDD			OP.1/2 FDD
Max number of HARQ 4			
Redundancy version     {0,1,2,3}       coding sequence     {0,1,2,3}			
Note 2: I	shall be updated in each TTI (1 ms granularity).		
Note 3: 0	<ul> <li>4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>One/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2 shall be used.</li> </ul>		

Table 9.4.2.1.1-1 PMI test for single-layer (FDD)

Table 9.4.2.1.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

# 9.4.2.1.2 TDD

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

Daram				
Parameter Unit Test 1			Test 1	
Bandwidth		MHz	10	
Transmission mode			6	
Uplink do			1	
configur				
Special su			4	
configur				
Propagation			EPA5	
Precoding g				
(only for repo	orting and	PRB	6	
following				
Correlatio			Low 2 x 2	
antenna con	figuration			
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	
allocation	σ	dB	0	
$N_{oc}^{(j)}$ dB[mW/15kHz] -98		-98		
Reporting mode PUSCH 1-2			PUSCH 1-2	
Reporting interval ms 1			1	
PMI delay ms 10 or 11		10 or 11		
R.11-3 TDD				
for UE			for UE	
Measurement channel			Category 1	
			R.11 TDD for	
			UE Category	
≥2				
OCNG Pattern OP.1/2 TDD		OP.1/2 TDD		
Max number of HARQ		Δ		
transmissions				
Redundancy version {0,1,2,3}			{0123}	
coding sequence				
ACK/NACK feedback Multiplexing				
Note 1: For random precoder selection, the precoders				
	shall be updated in each available downlink transmission instance.			
		orts in an available u	plink reporting	
instance at subrame SF#n based on PMI				
estimation at a downlink SF not later than SF#(n-				
4), this reported PMI cannot be applied at the				
eNB downlink before SF#(n+4). Note 3: One/two sided dynamic OCNG Pattern OP.1/				
		attern OP.1/2		
TC	DD as descr	cribed in Annex A.5.2.1/2 shall be		
used.				

Table 9.4.2.1.2-1 PMI test for single-layer (TDD)

Table 9.4.2.1.2-2 Minimum requirement (TDD)
---------------------------------------------

Parameter	Test 1
γ	1.2
UE Category	≥1

# 9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

## 9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmis	sion mode		6
Propagati	on channel		EVA5
	tion and onfiguration		Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N	•(j) oc	dB[mW/15kHz]	-98
PMI	delay	ms	8
Reporti	ng mode		PUSCH 2-2
Reportin	g interval	ms	1
Measurem	ent channel		R.14-2 FDD
OCNG	Pattern		OP.1/2 FDD
Subband size (k)		RBs	3 (full size)
Number of preferred subbands (M)			5
Max number of HARQ 4		4	
Redundancy version coding sequence {0,1,2,3}		{0,1,2,3}	
Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)			
Note 2: I	Note 2: If the UE reports in an available uplink reporting instance at		
subrame SF#n based on PMI estimation at a downlink SF not late			
than SF#(n-4), this reported PMI cannot be applied at the eNB			
downlink before SF#(n+4)			

Table 9.4.2.2.1-1 PMI test for single-layer (F	DD)
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Table 9.4.2.2.1-2	Minimum	requirement	(FDD)
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	Test 1
γ	1.2
UE Category	≥1

#### 9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmis	sion mode		6
	downlink Juration		1
	subframe		
	uration		4
	on channel		EVA5
	ition and onfiguration		Low 4 x 2
Downlink	$\rho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N	$d_{oc}^{(j)}$	dB[mW/15kHz]	-98
PMI	delay	ms	10
Reporti	ng mode		PUSCH 2-2
Reportin	ig interval	ms	1
Measurem	ent channel		R.14-2 TDD
OCNG	Pattern		OP.1/2 TDD
	d size ( <i>k</i> )	RBs	3 (full size)
Number of preferred subbands (M)			5
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
<ul> <li>Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.</li> <li>Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> </ul>			

Table 9.4.2.2.2-1	PMI test for	single-layer (TDD)

Table 9.4.2.2.2-2 Minimum	requirement (	(TDD)
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	Test 1
γ	1.15
UE Category	≥1

# 9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

## 9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

	meter	Unit	Test 1	
Bandwidth		MHz	10	
Transmission mode			9	
	on channel		EVA5	
	granularity		0	
(only for reporting and following PMI)		PRB	6	
	tion and		Low	
	onfiguration		ULA 4 x 2	
	ic reference		Antenna ports	
	nals		0,1	
	nce signals		Antenna ports 15,,18	
Beamform	ning model		Annex B.4.3	
	riodicity and			
	ne offset		5/ 1	
T <sub>CSI-RS</sub>	/ $\Delta_{CSI-RS}$			
	reference		8	
signal co	nfiguration		_	
	SubsetRestr		0x0000 0000	
iction	bitmap		0000 FFFF	
	$ ho_{\scriptscriptstyle A}$	dB	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	
allocation	Pc	dB	-3	
	σ	dB	-3	
	oc	dB[mW/15kHz]	-98	
	ng mode		PUSCH 1-2	
	g interval	ms	5	
PMI	delay	ms	8	
Measurement channel			R.45-1 FDD for UE Category 1, R.45 FDD for UE Category ≥2	
OCNG Pattern			OP.7 FDD for UE Category 1 OP.1 FDD for UE Category 2-8	
	er of HARQ		4	
Redundancy version coding sequence			{0,1,2,3}	
		recoder selection, th	ne precoders	
Note 2: I	<ul> <li>shall be updated in each TTI (1 ms granularity).</li> <li>If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-</li> </ul>			
<ul> <li>4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 3: Void.</li> <li>Note 4: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.</li> </ul>			= 0 dB in order	

Table 9.4.2.3.1-1 PMI test for single-layer (FDD)

Parameter	Test 1
γ	1.3
UE Category	≥1

Table 9.4.2.3.1-2 Minimum requirement (FDD)

#### 9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

	meter	Unit	Test 1			
	lwidth	MHz	10			
	sion mode		9			
	lownlink uration		1			
	subframe					
config	uration		4			
	on channel		EVA5			
	granularity		_			
	porting and	PRB	6			
	ng PMI) onfiguration		8 x 2			
			High, Cross			
Correlation	n modeling		polarized			
	c reference		Antenna ports			
sigr	nals		0,1			
CSI refere	nce signals		Antenna ports			
Beamform	ning model		15,,22 Annex B.4.3			
CSI-RS ner	riodicity and		7 111167 0.4.0			
subfram	ne offset		5/ 4			
T <sub>CSI-RS</sub>	/ $\Delta_{CSI-RS}$					
	reference		4			
signal cor	nfiguration					
CodoBook	SubsetRestr		0x0000 0000 001F FFE0			
	bitmap		0000 0000			
	onnap		FFFF			
	$\rho_{\scriptscriptstyle A}$	dB	0			
Downlink	$\rho_{\scriptscriptstyle B}$	dB	0			
power allocation	Pc	db	-6			
anocation	σ	dB	-3			
	( <i>j</i> )					
	oc	dB[mW/15kHz]	-98			
	ng mode		PUSCH 1-2			
	g interval	ms	5 (Note 4)			
PMI	delay	ms	10 R.45-1 TDD			
			for UE			
			Category 1,			
Measureme	ent channel		R.45 TDD for			
			UE Category			
			≥2			
			OP.7 TDD for			
	Pattern		UE Category 1 OP.1 TDD for			
00110	1 attern		UE Category			
			2-8			
	er of HARQ iissions		4			
	icy version		(0.4.2.2)			
coding s	equence		{0,1,2,3}			
	K feedback		Multiplexing			
	mode         mode           Note 1:         For random precoder selection, the precoders					
		ted in each TTI (1 m				
Note 2: I	f the UE repo	orts in an available u	plink reporting			
i	nstance at su	brame SF#n based	on PMI			
		a downlink SF not la				
		ed PMI cannot be ap	oplied at the			
	oid.	before SF#(n+4).				
		ormat 0 with a trigg	er for aperiodic			

Table 9.4.2.3.2-1 PMI test for single-layer (TDD)

	CQI shall be transmitted in downlink SF#4 and #9
	to allow aperiodic CQI/PMI/RI to be transmitted
	on uplink SF#3 and #8.
Note 5:	Randomization of the principle beam direction
	shall be used as specified in B.2.3A.4.

#### Table 9.4.2.3.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	3.5
UE Category	≥1

- 9.4.3 Void
- 9.4.3.1 Void
- 9.4.3.1.1 Void

9.4.3.1.2 Void

# 9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3, and transmission mode 10 is used with the specified CodebookSubSetRestriction in section 9.5.5.

For fixed rank 1 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to two singlelayer precoders, For fixed rank 2 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1, 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

# 9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

#### 9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

Parameter		Unit	Test 1	Test 2	Test 3		
Bandwidth		MHz		10			
PDSCH transmission mode				4			
$\rho_A$		dB		-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3			
anocation				0			
Propagation condit antenna configu			2 x 2 EPA5				
CodeBookSubsetRe				11 for fixed RI = 1			
bitmap	SUICION			20  for fixed  RI = 2			
			010011	for UE reported			
Antenna correla	ation		Low	Low	High		
RI configuration	n		Fixed RI=2 and	Fixed RI=1	Fixed RI=1		
	011		follow RI	and follow RI	and follow RI		
SNR		dB	0	20	20		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78		
Maximum number o transmission				1			
Reporting mo			PUCCH 1-1 (Note 4)				
Physical channel for			PUCCH Format 2				
reporting			1 BCCITI Offiliat 2				
PUCCH Report Ty CQI/PMI	/pe for		2				
Physical channel	for RI		PUSCH (Note 3)				
reporting PUCCH Report Typ	o for Pl			3			
Reporting period		mc	$N_{\rm pd}=5$				
PMI and CQI de		ms ms	8				
cqi-pmi-Configurati		1115	6				
ri-Configuration			1 (Note 5)				
		l /ailable.uplink.repor	ting instance at subfra		on PMI and		
			ot later than SF#(n-4),				
			NB downlink before S				
			according to Table A		ed dvnamic		
		FDD as described ir			<b>,</b>		
			d HARQ-ACK it is neo	cessary to report	both on		
PUSCH in	stead of PL	JCCH. PDCCH DCI	format 0 shall be tran	smitted in downli	nk SF#4 and		
#9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8							
and #3.							
Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:							
	<ul> <li>For reported RI = 1 and PMI = 0 &gt;&gt; precoding information bit field index = 1</li> </ul>						
<ul> <li>For reported RI = 1 and PMI = 1 &gt;&gt; precoding information bit field index = 2</li> </ul>							
<ul> <li>For reported RI = 2 and PMI = 0 &gt;&gt; precoding information bit field index = 0</li> <li>Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI</li> </ul>							
			ne subframe delay in a	addition to Note 1	to align with		
CQI and P	MI reports.						

Table 9.5.1.1-1 RI Test (FD	D)
-----------------------------	----

Table 9.5.1.1-2 Minimum	requirement (	(FDD)
-------------------------	---------------	-------

	Test 1	Test 2	Test 3
<i>)</i> 1	N/A	1.05	0.9
1/2	1	N/A	N/A
UE Category	≥2	≥2	≥2

# 9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

- The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when a) transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when b) transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz		10	
PDSCH transmission mode				4	
Damaliatara	$\rho_{A}$	dB	-3		
Downlink powe allocation	r $\rho_{\scriptscriptstyle B}$	dB	-3		
	σ	dB	0		
Uplink downlink	configuration			2	
Special su configur	bframe			4	
Propagation co antenna con				2 x 2 EPA5	
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI		
Antenna co	Antenna correlation		Low Low High		
RI configu	uration				Fixed RI=1 and follow RI
SNR		dB	0	20	20
$N_{oc}^{(j)}$	)	dB[mW/15kHz]	-98	-98	-98
$\hat{I}_{or}^{(j)}$	)	dB[mW/15kHz]	-98	-78	-78
Maximum numb transmis			1		·
Reporting	mode		PUS	CH 3-1 (Note 3)	
Reporting		ms		5	
PMI and C		ms	10 or 11		
ACK/NACK feedback mode Bundling					
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI an				ed on PMI and	
			ot later than SF#(n-4),		ll and
wideband CQI cannot be applied at the eNB downlink before SF#(n+4).					
	Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.				
			and sub-band COL	is discarded	

## Table 9.5.1.2-1 RI Test (TDD)

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

	Test 1	Test 2	Test 3
<i>)</i> 1	N/A	1.05	0.9
<i>Y</i> 2	1	N/A	N/A
UE Category	≥2	≥2	≥2

#### Minimum requirement (CSI Reference Symbols) 9.5.2

#### 9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

Parameter		Unit	Test 1	Test 2	Test 3		
Bandwidth		MHz		10			
PDSCH tr		n mode			9		
		$\rho_{A}$	dB		0		
Downlink	Downlink power $\rho_{\scriptscriptstyle B}$		dB		0		
allocat		PB	dB	0			
	<u>σ</u>		dB		0		
Propagat	Propagation condition and		db		•		
	a configur				2 x 2 EPA5		
Cell-specifi	<u> </u>			Ar	ntenna ports 0		
	forming M			As specified in Section B.4.3			
CSI ref	erence sig	gnals		Ante	nna ports 15, 16		
subf	periodicit frame offs	et			5/1		
	I-RS / ACSI-F						
	ference si nfiguratior				6		
CodeBook	SubsetRe	striction			11 for fixed $RI = 1$		
	bitmap				D0 for fixed RI = $2$		
Anton	na correla	tion		Low	for UE reported Low	High	
				Fixed RI=2 and	Fixed RI=1	Fixed RI=1	
RIc	onfiguratio	on		follow RI	and follow RI	and follow RI	
	SNR		dB	0	20	20	
	$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
	$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	
Maximum	number o nsmission			1			
	orting mo			PUCCH 1-1			
Physical ch				PUSCH (Note 3)			
PUCCH	Report Ty	/pe for		2			
	CQI/PMI	( D)		2			
-	l channel	IOF RI		PU	CCH Format 2		
PUCCH R		e for RI			3		
	ting period		ms		$N_{\rm pd} = 5$		
	ind CQI de		ms		8		
	Configurati				2		
ri-Coi	nfiguration	Ind			1 (Note 4)		
				porting instance at sub			
				ot later than SF#(n-4),		ll and	
Note 2: F	wideband CQI cannot be applied at the eNB downlink before SF#(n+4). Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic						
Note 3: T			tween CQI/ PMI rep	oorts and HARQ-ACK			
	PUSCH instead of PU #6 to allow periodic C			format 0 shall be tran with the HARQ-ACK			
	ŧ5.				· · · · • •		
Note 4: To avoid the ambiguit reports are to be appl CQI and PMI reports.		ied at the TE with o					

#### Table 9.5.2.1-1 RI Test (FDD)

	Test 1	Test 2	Test 3
γı	N/A	1.05	0.9
<i>γ</i> 2	1	N/A	N/A
UE Category	≥2	≥2	≥2

 Table 9.5.2.1-2 Minimum requirement (FDD)

# 9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

Р	arameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz		10		
PDSCH tr		n mode			9	
		$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink	nower		dB			
	allocation / b		-		0	
		Pc	dB		0	
Uplink dow	unlink oonf	σ	dB		1	
	ial subfra				I	
	nfiguration				4	
	ion condit					
	a configur				2 x 2 EPA5	
Cell-specifi				Ar	ntenna ports 0	
	erence sig				nna ports 15, 16	
Beam	forming M	odel			fied in Section B.	4.3
	ference si				4	
	nfiguratior				4	
	periodicit				_ / .	
	frame offs				5/4	
I <sub>CS</sub>	$_{I-RS}$ / $\Delta_{CSI-F}$	RS		0000	14 for fired DL	1
CodeBook	SubsetRe	estriction			11 for fixed $RI = 1$	
	bitmap			010000 for fixed RI = 2 010011 for UE reported RI		
Anten	na correla	ition		Low	Low	High
			Fixed RI=2 and	Fixed RI=1	Fixed RI=1	
RI configuration			follow RI	and follow RI	and follow RI	
SNR		dB	0	20	20	
	$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
	$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78
Maximum		f HARQ				
	nsmission				1	
	orting mo				PUCCH 1-1	
Physical ch	annel for	CQI/ PMI		DI	JSCH (Note 3)	
	reporting					
PUCCH re	eport type PMI	for CQI/			2	
	l channel	for RI		PU	CCH Format 2	
	eporting	1		-		
	ting period		ms		$N_{\rm pd} = 5$	
ACK/NAC	Ind CQI de		ms		10 Bundling	
	Configurati				4	
	nfiguratior				1	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).						
	5					ided dynamic
OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.						
F	Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and					

# Table 9.5.2.2-1 RI Test (TDD)

Table 9.5.2.2-2 Minimum re	quirement (TDD)

	Test 1	Test 2	Test 3
<i>)</i> /1	N/A	1.05	0.9
1/2	1	N/A	N/A
UE Category	≥2	≥2	≥2

# 9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

## 9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ 

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

<b>D</b>			Т	est 1	Tes	it 2
Parameter		Unit	Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth		MHz		10	1	
PDSCH transmissio	n mode		3	Note 10	3	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3	-3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		3
_	σ	dB		0	C	1
Propagation condit antenna configur				2 EPA5	2 x 2	EPA5
CodeBookSubsetRestriction bitmap			01 for fixed RI = 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A
Antenna correla	tion			ow	Lo	W
RI configuration	on		Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
$\widehat{E}_{s}/N_{oc2}$		dB	0	-12	20	6
	$N_{oc1}^{(j)}$		-98 (Note 3)	N/A	-102 (Note 3)	N/A
$N_{\scriptscriptstyle oc}^{(j)}$	$N_{oc2}^{(j)}$	dBmW/15kH z	-98 (Note 4)	N/A	-98 (Note 4)	N/A
	$N_{oc3}^{(j)}$	dB[mW/15k	-98 (Note 5)	N/A	-94.8 (Note 5)	N/A
$\hat{I}^{(j)}_{or}$	$\hat{I}^{(j)}_{or}$		-98	-110	-78	-92
Subframe Configu	iration		Non- MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset betwee		μs	2.5 (synch N/A	ronous cells) 10000000 10000000 10000000 10000000 1000000	2.5 (synchro N/A	Inous cells)           10000000           10000000           10000000           10000000           10000000           10000000           10000000           10000000
RLM/RRM Measur Subframe Pattern (			10000000 10000000 10000000 10000000 1000000	N/A	10000000 10000000 10000000 10000000 1000000	N/A
CSI Subframe Sets (Note 8)	C <sub>CSI,0</sub>		10000000 1000000 1000000 1000000 1000000	N/A	10000000 10000000 10000000 10000000 0111111	N/A
Number of control OFDM Symbols			3	3	3	3
Maximum number of HARQ transmissions Reporting mode			PUC	1 CH 1-0	1 PUCC	
Physical channel f reporting	or CQI		PUCCH	I Format 2	PUCCH	Format 2
PUCCH Report Type	e for CQI			4	4	ļ

# Table 9.5.3.1-1 RI Test (FDD)

Physical channel for RI reporting			PUCCH Format 2		PUCCH	Format 2
PUCCH Report Type for RI			3		3	
Re	porting periodicity	ms	Npd	= 10	N <sub>pd</sub> =	= 10
cqi-pn	ni-ConfigurationIndex		1	1	1	1
ri-	ConfigurationInd		1	5	5	5
cqi-pm	ni-ConfigurationIndex2		1	0	1	0
ri-0	ConfigurationInd2			2	2	2
	Cyclic prefix		Normal	Normal	Normal	Normal
Note 1:	If the UE reports in an av					
	a downlink subframe not downlink before SF#(n+4		n-4), this repor	ted wideband (	CQI cannot be app	lied at the eNB
Note 2:	Reference measurement				ble A.4-1 with one	sided dynamic
	OCNG Pattern OP.1 FD					
Note 3:	This noise is applied in C		<b>#1, #2, #3, #5</b> , #	#6, #8, #9, #10	,#12, #13 of a sub	oframe
	overlapping with the agg					
Note 4:	This noise is applied in C ABS.	)FDM symbols #	#0, #4, #7, #11	of a subframe	overlapping with the	he aggressor
Note 5:	This noise is applied in a	II OFDM symbo	Is of a subfram	e overlapping	with aggressor nor	n-ABS
Note 6:	ABS pattern as defined i	n [9]. PDSCH of	her than SIB1/	paging and its	associated PDCC	H/PCFICH are
	transmitted in the serving	g cell subframe	when the subfr	ame is overlap	ped with the ABS	subframe of
	aggressor cell and the su	ubframe is availa	able in the defir	nition of the ref	erence channel.	
Note 7:	Time-domain measurem					
Note 8:	As configured according		ain measurem	ent resource re	estriction pattern for	or CSI
	measurements defined in [7].					
Note 9:	Cell 1 is the serving cell.	gressor cell. Th	ne number of th	e CRS ports in Ce	ell 1 and Cell 2	
	is the same.					
Note 10:	Downlink physical chann defined in Annex A.5.1.5		2 in accordanc	e with Annex C	C.3.3 applying OCN	NG pattern as

## Table 9.5.3.1-2 Minimum requirement (FDD)

	Test 1	Test 2
<i>γ</i> 1	0.9	1.05
UE Category	≥2	≥2

# 9.5.3.2 TDD

The minimum performance requirement in Table 9.5.3.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ .

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

Parameter		Unit	Tes		Tes	
			Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth PDSCH transmissio	n modo	MHz	1 3	Note 11	1( 3	Note 11
Uplink downlink conf			 1		3 1	
	Special subframe				-	
configuration			4		4	
	$ ho_{\scriptscriptstyle A}$	dB	-3	3	-3	3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-:	3	-3	3
anocation	σ	dB	C	)	0	
Propagation condit			2 x 2 l	EPA5	2 x 2 E	PA5
antenna configur	ation				2721	1 45
CodeBookSubsetRe bitmap	estriction		01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A
Antenna correla	ition		Lo	W	Lo	W
RI configuration			Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
$\widehat{E}_{s}/N_{oc2}$		dB	0	-12	20	6
	$N_{ocl}^{(j)}$		-98 (Note 4)	N/A	-102 (Note 4)	N/A
$N_{oc}^{(j)}$	$N_{oc2}^{(j)}$	dB[mW/15k Hz]	-98 (Note 5)	N/A	-98 (Note 5)	N/A
	$N_{oc3}^{(j)}$	dB[mW/15k	-98 (Note 6)	N/A	-94.8 (Note 6)	N/A
$\hat{I}^{(j)}_{or}$	$\hat{I}_{or}^{(j)}$		-98	-110	-78	-92
Subframe Configu	iration		Non- MBSFN	Non- MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset betwee	en Cells	μs	2.5 (synchronous cells)		2.5 (synchronous cells)	
ABS Pattern (No	te 7)		N/A	0000000 001 0000000 001	N/A	0000000001 0000000001
RLM/RRM Measu Subframe Pattern (			00000000 01 00000000 01	N/A	0000000001 0000000001	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		00000000 01 00000000 01	N/A	0000000001 0000000001	N/A
(Note 9)	C <sub>CSI,1</sub>		11001110 00 11001110 00		1100111000 1100111000	
Number of control Symbols	OFDM		3	3	3	3
Maximum number o	f HARQ		1		1	
transmission					-	
Reporting mo			PUCC	H 1-0	PUCC	H 1-0
Physical channel for and RI reporting			PUCCH I	Format 2	PUCCH	Format 2
			4	ļ.	4	
PUCCH Report Type for CQI		1	ц			

# Table 9.5.3.2-1 RI Test (TDD)

	Physical channel for C <sub>CSI,1</sub> CQI and RI reporting		PUSCH (Note 3)		PUSCH (Note 3)	
	Report Type for RI		3	3	3	3
	orting periodicity	ms	N <sub>pd</sub> =	= 10	N <sub>pd</sub> =	= 10
ACK/NA	CK feedback mode		Multip	lexing	Multip	lexing
	-ConfigurationIndex		8		8	
	ConfigurationInd		5		5	
	ConfigurationIndex2		ç		ç	-
	onfigurationInd2		C		0	
	Cyclic prefix		Normal	Normal	Normal	Normal
Note 1:	If the UE reports in an estimation at a downli be applied at the eNB	nk subframe n downlink befo	ot later than S re SF#(n+4).	SF#(n-4), this	reported wideba	nd CQI cannot
Note 2:	Reference measurem dynamic OCNG Patte					with one sided
Note 3:	To avoid collisions be PUSCH instead of PU allow periodic RI/CQI	ICCH. PDCCH	DCI format (	) shall be tra	nsmitted in downli	ink SF#9 to
Note 4:	This noise is applied i overlapping with the a	n OFDM symb	ols #1, #2, #3			
Note 5:	This noise is applied i aggressor ABS.			7, #11 of a sι	bframe overlappi	ng with the
Note 6:	This noise is applied i	n all OFDM sy	mbols of a su	bframe over	apping with aggre	essor non-ABS
Note 7:	ABS pattern as define					
	PDCCH/PCFICH are with the ABS subfram	transmitted in t	the serving ce	ell subframe	when the subfram	e is overlapped
	reference channel.					
Note 8:	Time-domain measure [7].	ement resource	e restriction p	attern for PC	ell measurements	s as defined in
Note 9:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].					
Note 10:						
Note 11:	Downlink physical cha pattern as defined in A		Cell 2 in acco	rdance with	Annex C.3.3 apply	ying OCNG

Table 9.5.3.2-2 Minimum requirement (TDD)

	Test 1	Test 2
<i>)</i> 1	0.9	1.05
UE Category	≥2	≥2

9.5.4 Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)

#### 9.5.4.1 FDD

For the parameters specified in Table 9.5.4.1-1, the minimum performance requirement in Table 9.5.4.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{1;}$
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmissio	n mode		3	As defined in Note 1	As defined in Note 1
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
	σ	dB	0	N/A	N/A
Propagation conditi antenna configur			2×2 EPA5 (Note 2)	2×2 EPA5 (Note 2)	2×2 EPA5 (Note 2)
CodeBookSubsetRe bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	As defined in Note 1	As defined in Note 1
	N <sub>oc1</sub>	dB[mW/15k Hz]	-98 (Note 3)	N/A	N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	N <sub>oc3</sub>	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
$\widehat{E}_s/N_{oc2}$		dB	Reference Value in Table 9.5.4.1-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	Reference Value in Table 9.5.4.1-2 for each test	-86	-88
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset between Cells		μs	N/A	3	-1
Frequency shift between Cells		Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 6)		N/A	1000000 1000000 1000000 1000000 1000000	10000000 10000000 10000000 10000000 1000000
RLM/RRM Measur Subframe Pattern (			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		10000000 10000000 10000000 10000000 1000000	N/A	N/A
(Note 8)	C <sub>CSI,1</sub>		01111111 01111111 01111111 01111111 0111111	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number o			1	N/A	N/A
transmissions Reporting mode			PUCCH 1-0	N/A	N/A
Physical channel for			PUCCH format 2	N/A	N/A
reporting PUCCH Report Type	for COI		4	N/A	N/A
Physical channel for R	I reportina	<u> </u>	PUCCH Format 2	N/A N/A	N/A N/A
PUCCH Report Typ			3	N/A	N/A
Reporting period		ms	N <sub>pd</sub> = 10	N/A	N/A

# Table 9.5.4.1-1: RI Test (FDD)

cqi-pm	ni-ConfigurationIndex		11	N/A	N/A	
ri-	ConfigurationInd		5	N/A	N/A	
cqi-pm	i-ConfigurationIndex2		10	N/A	N/A	
ri-C	ConfigurationInd2		2	N/A	N/A	
	Cyclic prefix		Normal	Normal	Normal	
Note 1:	Downlink physical chan			n Annex C.3.3 app	lying OCNG	
	pattern OP.5 FDD as de					
Note 2:	The propagation conditi					
Note 3:	This noise is applied in		#1, #2, #3, #5, #6, #8	3, #9, #10,#12, #1	3 of a subframe	
	overlapping with the age					
Note 4:	This noise is applied in aggressor ABS.	OFDM symbols	#0, #4, #7, #11 of a s	subframe overlapp	oing with the	
Note 5:	This noise is applied in a	all OFDM symbo	ols of a subframe ove	rlapping with agg	ressor non-ABS	
Note 6:	ABS pattern as defined					
	PDCCH/PCFICH are tra					
	overlapped with the ABS	S subframe of a	ggressor cell and the	subframe is available	able in the	
	definition of the reference					
Note 7:	Time-domain measurem [7]	nent resource re	striction pattern for P	Cell measuremen	its as defined in	
Note 8:	As configured according measurements defined		nain measurement re	source restriction	pattern for CSI	
Note 9:	The number of control C		s not available for AB	S and is 3 for the	subframe	
	indicated by "0" of ABS					
Note 10:	If the UE reports in an a		eporting instance at s	subframe SF#n ba	sed on CQI	
	estimation at a downlink	subframe not la	ater than SF#(n-4), th	is reported wideb	and CQI cannot	
	be applied at the eNB downlink before SF#(n+4).					
Note 11:	Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided					
	dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.					
Note 12:	The number of the CRS			e same.		
Note 13:	SIB-1 will not be transm	itted in Cell2 an	d Cell 3 in this test.			

#### Table 9.5.4.1-2 Minimum requirement (FDD)

	Test 1	Test 2	Test 3
$\widehat{E}_{s}/N_{oc2}$ for Cell 1 (dB)	4	20	20
$\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])	-94	-78	-78
Antenna correlation	High for Cell 1, low for Cell 2 and Cell 3	Low for Cell 1, Cell 2 and Cell 3	High for Cell 1, low for Cell 2 and Cell 3
у	N/A	1.05	0.9
1/2	1.05	N/A	N/A
UE Category	≥2	≥2	≥2

## 9.5.4.2 TDD

For the parameters specified in Table 9.5.4.2-1, the minimum performance requirement in Table 9.5.4.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{1;}$
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmission mode			3	As defined in Note 1	As defined in Note 1
Uplink downlink configuration			1	1	1
Special subframe configuration			4	4	4
	$ ho_{\scriptscriptstyle A}$	dB -3		-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
	σ	dB	0	N/A	N/A
Propagation conditi antenna configura			2x2 EPA5 (Note 2)	2×2 EPA5 (Note 2)	2×2 EPA5 (Note 2)
CodeBookSubsetRe bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	As defined in Note 1	As defined in Note 1
	$N_{oc1}$	dB[mW/15k Hz]	0         N/A           2x2 EPA5 (Note 2)         2x2 EPA5 (Note 2)           01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI         As defined i Note 1           -98 (Note 3)         N/A           -98 (Note 3)         N/A           -98 (Note 3)         N/A           -98 (Note 5)         N/A           Reference Value in Table 9.5.4.2-2 for each test         12           Reference Value in Table 9.5.4.2-2 for each test         -86           Non-MBSFN         Non-MBSFI           N/A         300           0         126           N/A         000000000           0000000001         N/A		N/A
$N_{oc}$ at antenna port	$N_{oc2}$	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	$N_{oc3}$	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
$\widehat{E}_s/N_{oc2}$	$\widehat{E}_{s}/N_{oc2}$		in Table 9.5.4.2-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	in Table 9.5.4.2-2 -86		-88
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset between Cells		μs	N/A	3	-1
Frequency shift between Cells		Hz	N/A	300	-100
Cell Id			0		1
ABS pattern (No	te 6)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 N/A		N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		0000000001 0000000001		
(Note 8)	(Note 8) 1100111000			N/A	N/A
Number of control symbols	Number of control OFDM symbols		3	Note 9	Note 9
Maximum number o transmissions	Maximum number of HARQ		1	N/A	N/A
Reporting mode			PUCCH 1-0	N/A	N/A
Physical channel for C <sub>CSI,0</sub> CQI and RI reporting			PUCCH format 2	N/A	N/A
Physical channel for C <sub>CSI,1</sub> CQI and RI reporting			PUSCH (Note 14)	N/A	N/A
PUCCH Report Type for CQI			4	N/A	N/A
PUCCH Report Type for RI			3	N/A	N/A
Reporting periodicity		ms	<i>N<sub>pd</sub></i> = 10	N/A	N/A
ACK/NACK feedbac			Multiplexing	N/A	N/A
cqi-pmi-Configuratio			8	N/A	N/A
ri-Configuration			5	N/A	N/A
cqi-pmi-Configuratio			9	N/A	N/A
ri-Configuration			0	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

# Table 9.5.4.2-1: RI Test (TDD)

Note 1:	Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.
Note 2:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
Note 3:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 5:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 6:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is
	overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
Note 7:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 8:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 9:	The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by "0" of ABS pattern.
Note 10:	If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
Note 11:	
Note 12:	•
Note 13:	
Note 14:	To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on
	PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and
	#9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe
	SF#8 and #3.

#### Table 9.5.4.2-2 Minimum requirement (TDD)

	Test 1	Test 2	Test 3
$\widehat{E}_{s}/N_{oc2}$ for Cell 1 (dB)	4	20	20
$\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])	-94	-78	-78
Antenna correlation	High for Cell 1, low for Cell 2 and Cell 3	Low for Cell 1, Cell 2 and Cell 3	High for Cell 1, low for Cell 2 and Cell 3
<i>γ</i> 1	N/A	1.05	0.9
1/2	1.05	N/A	N/A
UE Category	≥2	≥2	≥2

# 9.5.5 Minimum requirement (with CSI process)

Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.5.5-1.

For UE supports one CSI process, CSI process 0 is configured for Test 1 and Test 2, but CSI process 1 is not configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled. The requirement on reported RI for CSI process 1 in Test 2 is not applicable.

For UE supports multiple CSI processes, CSI process 0 is configured for Test 1 and CSI processes 0 and 1 are configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled, and also the requirement on reported RI for CSI process 1 in Test 2.

Table 9.5.5-1	Configuration	of CSI processes
---------------	---------------	------------------

	CSI process 0	CSI process 1
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 1

## 9.5.5.1 FDD

The minimum performance requirement in Table 9.5.5.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.1-2.

# Table 9.5.5.1-1 RI Test (FDD)

Derr	motor	Unit	Tes	st 1	Te	st 2
Parameter			TP1	TP2	TP1	TP2
Bandwidth		MHz		MHz		MHz
Transmission mode	)		10	10	10	10
	$ ho_{\scriptscriptstyle A}$	dB		0		0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	0	
allocation	P <sub>c</sub>	dB	0	0	0	0
	σ	dB		0	-	0
SNR	0	dB	0	0	20	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78
		ub[IIIW/I5KI12]	-90	-90	-70	-70
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-98	
Propagation channel	el		EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High
Antenna configurati			2x2	2x2	2x2	2x2
Beamforming Mode			As specified in	Section B.4.3	As specified in	Section B.4.3
Timing offset betwe		us		0		0
Frequency offset be		Hz		0 Deserte 0		0 Disporte 0
Cell-specific referer	ive signals		Antenna ports	a ports 0	Antenna ports	a ports 0
CSI-RS signal 0			15,16	N/A	15,16	N/A
CSI-RS 0 periodicit T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>	y and subframe offset		5/1	N/A	5/1	N/A
CSI-RS 0 configura	tion		0	N/A	0	N/A
CSI-RS signal 1			N/A	Antenna ports 15,16	N/A	Antenna ports 15,16
CSI-RS 1 periodicit T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>	y and subframe offset		N/A	5/1	N/A	5/1
CSI-RS 1 configuration			N/A	3	N/A	3
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap			N/A	1 / 10000010000 00000	N/A	1 / 10000010000 00000
Zero-power CSI-RS 1 configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap			1 / 00110000000 00000	N/A	1 / 00110000000 00000	N/A
CSI-IM 0 periodicity T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>	and subframe offset		5/1	N/A	5/1	N/A
CSI-IM 0 configurat	ion		2	N/A	2	N/A
CSI-IM 1 periodicity T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	and subframe offset		N/A	5/1	N/A	5/1
CSI-IM 1 configurat	ion		N/A	6	N/A	6
RI configuration			Fixed RI=2 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
Physical channel fo	r CQI/PMI reporting		PUSCH (Note 6)	N/A	PUSCH (Note 6)	PUSCH (Note 6)
PUCCH Report Typ	e for CQI/PMI		2	N/A	2	2
Physical channel fo			PUCCH Format 2	N/A	PUCCH Format 2	PUCCH Format 2
PUCCH Report Typ	be for RI		3	N/A	3	3
	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A
	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A
	Reporting mode		PUCCH 1-1	N/A	PUCCH 1-1	N/A
CSI process 0 (Note 7)	Reporting periodicity	ms	$N_{\rm pd}=5$	N/A	$N_{\rm pd}=5$	N/A
	CQI delay	ms	8	N/A	10	N/A
	cqi-pmi- ConfigurationIndex		6	N/A	6	N/A
	ri-ConfigIndex		1	N/A	1	N/A
	CSI-RS		N/A	N/A	N/A	CSI-RS 1
CSI process 1	CSI-IM		N/A	N/A	N/A	CSI-IM 1
(Note 7, Note 9)	Reporting mode		N/A	N/A	N/A	PUCCH 1-1
	Reporting periodicity	ms	N/A	N/A	N/A	$N_{\rm pd}=5$

	CQI delay	ms	N/A	N/A	N/A	10
	cqi-pmi- ConfigurationIndex		N/A	N/A	N/A	4
	ri-ConfigIndex		N/A	N/A	N/A	1
CSI proce	ess for PDSCH scheduling		CSI process 0		CSI process 0	
Cell ID			0	6	0	6
Quasi-co-	-located CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co	-located CRS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2
PMI for s	ubframe 2, 3, 4, 7, 8 and 9		010000 for fixed RI = 2 010011 for UE reported RI	100000	000011 for fixed RI = 1 010011 for UE reported RI	N/A
PMI for subframe 1 and 6			100000	100000	100000	N/A
Max number of HARQ transmissions			1	N/A	1	N/A
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)						
Note 2: 3 symbols allocated to PDCCH						
Note 3: Reference measurement channel RC.13 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.						
Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1. Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is						

Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.

Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.

Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Note 9: If UE supports one CSI process, CSI process 1 is not configured in Test 2.

#### Table 9.5.5.1-2 Minimum requirement (FDD)

	Test 1	Test 2
<i>γ</i> 1	N/A	1.0
<i>j</i> 2	1.0	N/A
UE Category	≥2	≥2

#### 9.5.5.2 TDD

The minimum performance requirement in Table 9.5.5.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.2-2.

## Table 9.5.5.2-1 RI Test (TDD)

Parameter			Te	st 1	Te	st 2
Para	ameter	Unit	TP1	TP2	TP1	TP2
Bandwidth			10 MHz		10 MHz	
ransmission mode			10	10	10	10
	$ ho_{\scriptscriptstyle A}$	dB	(	D	(	C
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	(	0	(	C
allocation	$P_c$	dB	0	0	0	0
	σ	dB	_	)	-	) )
Uplink downlink co	-	uD	2	2	2	2
Special subframe of			4	4	4	4
SNR	Jernigereiten	dB	0	0	20	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-2	98
Propagation chann	el		EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High
Antenna configurat	tion		2x2	2x2	2x2	2x2
Beamforming Mode			As specified in	Section B.4.3	As specified in	Section B.4.3
Timing offset betwe		us		0		0
Frequency offset b		Hz		0		0
Cell-specific refere	nce signals			a ports 0		a ports 0
CSI-RS signal 0			Antenna ports 15,16	N/A	Antenna ports 15,16	N/A
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ty and subframe offset		5/3	N/A	5/3	N/A
CSI-RS 0 configura	ation		0	N/A	0	N/A
CSI-RS signal 1			N/A	Antenna ports 15,16	N/A	Antenna port 15,16
CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$			N/A	5/3	N/A	5/3
CSI-RS 1 configura	ation		N/A	3	N/A	3
Zero-power CSI-RS 0 configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap			N/A	3 / 10000010000 00000	N/A	3 / 10000010000 00000
Zero-power CSI-RS I <sub>CSI-RS</sub> / ZeroPower			3 / 00110000000 00000	N/A	3 / 00110000000 00000	N/A
CSI-IM 0 periodicity T <sub>CSI-RS</sub> / A <sub>CSI-RS</sub>	y and subframe offset		5/3	N/A	5/3	N/A
CSI-IM 0 configura	tion		2	N/A	2	N/A
CSI-IM 1 periodicity T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>	y and subframe offset		N/A	5/3	N/A	5/3
CSI-IM 1 configura	tion		N/A	6	N/A	6
RI configuration			Fixed RI=2 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A
CSI process 0	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A
(Note 6, 7)	Reporting mode		PUSCH 3-1	N/A	PUSCH 3-1	N/A
	Reporting Interval	ms	5	N/A	5	N/A
	CQI delay	ms	11	N/A	11	N/A
	CSI-RS		N/A	N/A	N/A	CSI-RS 1
CSI process 1	CSI-IM		N/A	N/A	N/A	CSI-IM 1
(Note 6, 7, 8)	Reporting mode		N/A N/A	N/A N/A	N/A N/A	PUSCH 3-1
-	Reporting Interval CQI delay	ms	N/A N/A	N/A N/A	N/A N/A	5 11
CSI process for PD		ms		DCess 0		Dicess 0
Cell ID			0	6	0	6
Quasi-co-located C	CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
			Same Cell ID	Same Cell ID	Same Cell ID	Same Cell IE
Quasi-co-located C	CRS		as Cell 1 010000 for	as Cell 2	as Cell 1 000011 for	as Cell 2
PMI for subframe 4	l and 9		fixed RI = 2 010011 for UE	100000	fixed RI = 1 010011 for UE	N/A

			reported RI		reported RI		
PMI for su	bframe 3 and 8		100000	100000	100000	N/A	
Max numb	er of HARQ transmissions		1	N/A	1	N/A	
ACK/NACI	K feedback mode		Multiplexing	N/A	Multiplexing	N/A	
	If the UE reports in an available					downlink SF not	
	later than SF#(n-4), this reported	d wideband CQI cann	ot be applied at th	ne eNB downlink b	pefore SF#(n+4)		
Note 2:	3 symbols allocated to PDCCH						
Note 3:	Reference measurement channel	el RC.13 TDD accord	ing to Table A.4-1	. PDSCH transmi	ssion is schedule	d on subframe 4	
	and 9 from TP1.						
Note 4:	TM10 OCNG as specified in A.5	5.2.8 is transmitted on	subframe 3 and 8	3 from TP1.			
Note 5:	TM10 OCNG as specified in A.5	5.2.8 is transmitted on	subframe 3, 4, 8	and 9 from TP2 fo	or Test 1; TP2 is b	lanked for Test	
	2.						
Note 6:	Reported wideband CQI and PM	/II are used and sub-b	and CQI is discar	ded.			
	If UE supports multiple CSI proc				process' for CSI	process 1.	
Note 8:	If UE supports one CSI process, CSI process 1 is not configured in Test 2.						
Note 9:	PDCCH DCI format 0 with a trig	ger for aperiodic CQI	shall be transmitte	ed in downlink SF	#3and #8 to allow	aperiodic	
	CQI/PMI/RI to be transmitted in	uplink SF#7 and #2.					
L		uplink of $\pi I$ and $\pi Z$ .					

Table 9.5.5.2-2 Minimum r	equirement (	(TDD)
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	Test 1	Test 2
<i>)</i> 1	N/A	1.0
1/2	1.0	N/A
UE Category	≥2	≥2

# 9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

# 9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

#### 9.6.1.1 FDD

The following requirements apply to UE Category  $\geq 3$ . For the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}-wideband\ CQI_{Scell} \geq 2$ 

for more than 90% of the time.

Parameter		Unit	Pcell	Scell		
PDSCH transmissio	on mode			1		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0			
allocation	$ ho_{\scriptscriptstyle B}$	dB		0		
Propagation condit antenna configur			AWGN (1 x 2)			
SNR		dB	10	4		
$\hat{I}^{(j)}_{or}$	<sup>i)</sup> dB[mW/15kHz] -88 -94		-94			
$N_{oc}^{(j)}$	dB[mW/15kHz] -98 -98		-98			
Physical channel f reporting	or CQI		PUCCH Format 2			
PUCCH Report Type				4		
Reporting period	dicity	ms	N <sub>pd</sub>	= 10		
cqi-pmi-ConfigurationIndex			16 [shift of 5 ms relati to Pcell]			
			DSCH for user data is sche as described in Annex A.5	eduled for the UE with one .1.1.		

## Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD)

#### Table 9.6.1.1-2: PUCCH 1-0 static test (FDD)

Test number		Bandwidth combination	
1		10MHz for both cells	
2		20MHz for both cells	
Note 1:	The app	blicability of requirements for different CA configurations and	
	bandwid	dth combination sets is defined in 9.1.1.2.	

#### 9.6.1.2 TDD

The following requirements apply to UE Category  $\geq 3$ . For the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}-wideband\ CQI_{Scell} \geq 2$ 

for more than 90% of the time.

Parameter	Parameter		Pcell	Scell	
PDSCH transmissio	on mode			1	
Uplink downlink cont	Uplink downlink configuration			2	
Special subfra configuration			4		
Downlink power $\rho_A$		dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condition and antenna configuration			AWGN (1 x 2)		
SNR		dB	10	4	
$\hat{I}^{(j)}_{or}$	$\hat{I}^{(j)}_{or}$		-88	-94	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	
Physical channel f reporting	or CQI		PUCC	H Format 2	
PUCCH Report			4		
Reporting period	dicity	ms	N	<sub>pd</sub> = 10	
cqi-pmi-ConfigurationIndex			8 13 [shift of 5 ms relation 13 [shift of 5 ms r		
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.					

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD)

#### Table 9.6.1.2-2: PUCCH 1-0 static test (TDD)

Test number		Bandwidth combination		
1		20MHz for both cells		
Note 1:	The applicability of requirements for different CA configuration and bandwidth combination sets is defined in 9.1.1.2.			

# 10 Performance requirement (MBMS)

# 10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Parameter	Unit	Value			
Number of HARQ processes	Processes	None			
Subcarrier spacing	kHz	15 kHz			
Allocated subframes per Radio Frame (Note 1)		6 subframes			
Number of OFDM symbols for PDCCH		2			
Cyclic Prefix		Extended			
Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.					

# 10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

Parameter		Unit	Test 1-4			
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0			
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)			
	σ	dB	0			
$N_{oc}$ at antenna port		dBm/15kHz	-98			
Note 1: $P_B = 0$ .						

Table 10.1.1-1: Test Parameters for Testing

Table 10.1.1-2: Minimum performance

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		MBMS
number		Channel	Pattern	condition	Matrix and antenna	BLER (%)	SNR(dB)	UE Category
1	10 MHz	R.37 FDD	OP.4 FDD				4.1	≥1
2	10 MHz	R.38 FDD	OP.4 FDD	MBSFN channel	1×2 low	4	11.0	≥1
3	10 MHz	R.39 FDD	OP.4 FDD	model (Table B.2.6-1)	1x2 low	I	20.1	≥2
	5.0MHz	R.39-1 FDD	OP.4 FDD				20.5	1

# 10.2 TDD (Fixed Reference Channel)

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Parai	meter	Unit	Value								
	of HARQ esses	Processes	None								
Subcarrie	er spacing	kHz	15 kHz								
	bframes per ne (Note 1)		5 subframes								
	of OFDM or PDCCH		2								
Cyclic	Prefix		Extended								
		Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.									

Table 10.2-1: Common Test Parameters (TDD)

# 10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

Parameter		Unit	Test 1-4
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at antenna	port	dBm/15kHz	-98
Note 1: $P_B = 0$ .			

Table 10.2.1-1: Test Parameters for Testing

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Referen	ce value	MBMS
number		Channel	Pattern	condition	Matrix and	BLER	SNR(dB)	UE
					antenna	(%)		Category
1	10 MHz	R.37 TDD	OP.4				3.4	≥1
			TDD					
2	10 MHz	R.38 TDD	OP.4	MBSFN			11.1	≥1
			TDD	channel	1x2 low	1		
3a	10 MHz	R.39 TDD	OP.4	model (Table	TXZ IOW	I	20.1	≥2
			TDD	B.2.6-1)				
3b	5MHz	R.39-1 TDD	OP.4				20.5	1
			TDD					

# Annex A (normative): Measurement channels

# A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

# A.2 UL reference measurement channels

# A.2.1 General

## A.2.1.1 Applicability and common parameters

The following sections define the UL signal applicable to the Transmitter Characteristics (clause 6) and for the Receiver Characteristics (clause 7) where the UL signal is relevant.

The Reference channels in this section assume transmission of PUSCH and Demodulation Reference signal only. The following conditions apply:

- 1 HARQ transmission
- Cyclic Prefix normal
- PUSCH hopping off
- Link adaptation off
- Demodulation Reference signal as per TS 36.211 [4] subclause 5.5.2.1.2.

Where ACK/NACK is transmitted, it is assumed to be multiplexed on PUSCH as per TS 36.212 [5] subclause 5.2.2.6.

- ACK/NACK 1 bit
- ACK/NACK mapping adjacent to Demodulation Reference symbol
- ACK/NACK resources punctured into data
- Max number of resources for ACK/NACK: 4 SC-FDMA symbols per subframe
- No CQI transmitted, no RI transmitted

## A.2.1.2 Determination of payload size

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{\text{RB}}$ 

- 1. Calculate the number of channel bits  $N_{ch}$  that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

 $\min |R - (A + 24*(N_{CB} + 1)) / N_{ch}|, where N_{CB} = \begin{cases} 0, if C = 1\\ C, if C > 1 \end{cases}$  subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{\rm RB}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- c) For RMC-s, which at the nominal target coding rate do not cover all the possible UE categories for the given modulation, reduce the target coding rate gradually (within the same modulation), until the maximal possible number of UE categories is covered.

3. If there is more than one *A* that minimises the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

# A.2.1.3 Overview of UL reference measurement channels

In Table A.2.1.3-1 are listed the UL reference measurement channels specified in annexes A.2.2 and A.2.3 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.2.2 and A.2.3 as appropriate.

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Ful	I RB allocation, QP	SK	· · · · · · · · · · · · · · · · · · ·						
FDD	Table A.2.2.1.1-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.1.1-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.1.1-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.1.1-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.1.1-1		15	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.1.1-1		20	QPSK	1/6	100		≥ 1	
FDD, Ful	I RB allocation, 16-	QAM							
FDD	Table A.2.2.1.2-1		1.4	16QAM	3/4	6		≥ 1	
FDD	Table A.2.2.1.2-1		3	16QAM	1/2	15		≥ 1	
FDD	Table A.2.2.1.2-1		5	16QAM	1/3	25		≥ 1	
FDD	Table A.2.2.1.2-1		10	16QAM	3/4	50		≥ 2	
FDD	Table A.2.2.1.2-1		15	16QAM	1/2	75		≥ 2	
FDD	Table A.2.2.1.2-1		20	16QAM	1/3	100		≥ 2	
FDD, Par	rtial RB allocation,	QPSK	· · · · · · · · · · · · · · · · · · ·						
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	1		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	8		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	9		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	10		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	12		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	16		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	18		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	20		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	24		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	27		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	30		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	32		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	36		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	40		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	45		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	48		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	80		≥ 1	

Table A.2.1.3-1: Overview of UL reference measurement channels

			20	0001	A /F	04		
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	81	≥1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	90	≥1	
FDD Por	Table A.2.2.2.1-1	40.0444	20	QPSK	1/6	96	≥ 1	
	tial RB allocation,		4.4.00	16QAM	2/4			
FDD	Table A.2.2.2.2-1		1.4 - 20		3/4	1	≥1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	2	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	3	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	4	≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	5	≥1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	6	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	8	≥1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	9	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	10	≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	12	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	15	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	16	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	18	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	20	≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	24	≥1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	1/3	25	≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	1/3	27	≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	30	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	32	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	36	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	40	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	45	≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	48	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	3/4	50	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	3/4	54	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	60	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	64	≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	1/2	72	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	75	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	80	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	81	≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	2/5	90	≥ 2	
	Table A.2.2.2.2-1	SK	20	16QAM	2/5	96	≥ 2	
TDD, FU	Table A.2.3.1.1-1	JA	1.4	QPSK	1/3	6	≥ 1	
TDD	Table A.2.3.1.1-1 Table A.2.3.1.1-1		3	QPSK		-	≥ 1 ≥ 1	
TDD	Table A.2.3.1.1-1		5		1/3	15 25	≥ 1	
TDD	Table A.2.3.1.1-1 Table A.2.3.1.1-1		5 10	QPSK QPSK	1/3		≥ 1 ≥ 1	
TDD	Table A.2.3.1.1-1		10	QPSK	1/3 1/5	50 75	≥ 1	
TDD	Table A.2.3.1.1-1		20	QPSK	1/5	100	≥ 1	
	I RB allocation, 16-	QAM	20		1/0	100	- 1	
TDD, Ful	Table A.2.3.1.2-1	47.111	1.4	16QAM	3/4	6	≥ 1	
TDD	Table A.2.3.1.2-1		3	16QAM	1/2	15	≥ 1	
TDD	Table A.2.3.1.2-1		5	16QAM	1/2	25	≥ 1	
	1 abic 7.2.3.1.2-1		5		1/5	20	- 1	

Into         Table A2.31.21         Into         Table A2.32.11         Into         Ta	-			10	400.004	0/4	50		
TDDTable A.2.3.1.2.120160AM1/3100≥ 2TDD, Table A.2.3.2.1.11.4 - 20QPSK1/31≥ 1TDDTable A.2.3.2.1.11.4 - 20QPSK1/33≥ 11TDDTable A.2.3.2.1.11.4 - 20QPSK1/33≥ 11TDDTable A.2.3.2.1.11.4 - 20QPSK1/34≥ 11TDDTable A.2.3.2.1.11.4 - 20QPSK1/36≥ 11TDDTable A.2.3.2.1.13 - 20QPSK1/38≥ 11TDDTable A.2.3.2.1.13 - 20QPSK1/38≥ 11TDDTable A.2.3.2.1.13 - 20QPSK1/310≥ 11TDDTable A.2.3.2.1.13 - 20QPSK1/310≥ 11TDDTable A.2.3.2.1.15 - 20QPSK1/310≥ 11TDDTable A.2.3.2.1.15 - 20QPSK1/310≥ 11TDDTable A.2.3.2.1.15 - 20QPSK1/318≥ 11TDDTable A.2.3.2.1.15 - 20QPSK1/318≥ 11TDDTable A.2.3.2.1.15 - 20QPSK1/320≥ 11TDDTable A.2.3.2.1.110 - 20QPSK1/320≥ 11TDDTable A.2.3.2.1.110 - 20QPSK1/320≥ 11TDDTable A.2.3.2.1.110 - 20QPSK1/320≥ 11TDDTable A.2.3.	TDD	Table A.2.3.1.2-1		10	16QAM	3/4	50	 ≥ 2	
TDD, Partial RB allocation, QPSK         1/3         1         2         1           TDD         Table A.2.3.2.1.1         1.4.20         QPSK         1/3         2         2         1           TDD         Table A.2.3.2.1.1         1.4.20         QPSK         1/3         3         21           TDD         Table A.2.3.2.1.1         1.4.20         QPSK         1/3         4         2.1           TDD         Table A.2.3.2.1.1         1.4.20         QPSK         1/3         6         2.1           TDD         Table A.2.3.2.1.1         3.20         QPSK         1/3         8         2.1           TDD         Table A.2.3.2.1.1         3.20         QPSK         1/3         10         2.1           TDD         Table A.2.3.2.1.1         3.20         QPSK         1/3         10         2.1           TDD         Table A.2.3.2.1.1         5.20         QPSK         1/3         16         2.1           TDD         Table A.2.3.2.1.1         5.20         QPSK         1/3         16         2.1           TDD         Table A.2.3.2.1.1         10.20         QPSK         1/3         20         2.1           TDD         Table A.2.3.2.1.1									
TDD       Table A.2.3.2.1-1       1.4 - 20       OPSK       1/3       1       2.1         TDD       Table A.2.3.2.1-1       1.4 - 20       OPSK       1/3       3       2       2.1         TDD       Table A.2.3.2.1-1       1.4 - 20       OPSK       1/3       3       2       1         TDD       Table A.2.3.2.1-1       1.4 - 20       OPSK       1/3       6       2.1         TDD       Table A.2.3.2.1-1       1.4 - 20       OPSK       1/3       6       2.1         TDD       Table A.2.3.2.1-1       3 - 20       OPSK       1/3       16       2.1         TDD       Table A.2.3.2.1-1       3 - 20       OPSK       1/3       10       2.1         TDD       Table A.2.3.2.1-1       3 - 20       OPSK       1/3       16       2.1         TDD       Table A.2.3.2.1-1       5 - 20       OPSK       1/3       16       2.1         TDD       Table A.2.3.2.1-1       5 - 20       OPSK       1/3       18       2.1         TDD       Table A.2.3.2.1-1       10 - 20       OPSK       1/3       26       2.1         TDD       Table A.2.3.2.1-1       10 - 20       OPSK       1/3       30 </td <td></td> <td></td> <td></td> <td>20</td> <td>16QAM</td> <td>1/3</td> <td>100</td> <td>≥ 2</td> <td></td>				20	16QAM	1/3	100	≥ 2	
TDD       Table A.2.3.2.1.1       1.4 - 20       QPSK       1/3       2       2.1         TDD       Table A.2.3.2.1.1       1.4 - 20       QPSK       1/3       3       2.1         TDD       Table A.2.3.2.1.1       1.4 - 20       QPSK       1/3       5       2.1         TDD       Table A.2.3.2.1.1       3 - 20       QPSK       1/3       6       2.1         TDD       Table A.2.3.2.1.1       3 - 20       QPSK       1/3       6       2.1         TDD       Table A.2.3.2.1.1       3 - 20       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       3 - 20       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       5 - 20       QPSK       1/3       16       2.1         TDD       Table A.2.3.2.1.1       5 - 20       QPSK       1/3       18       2.1         TDD       Table A.2.3.2.1.1       5 - 20       QPSK       1/3       20       2.1         TDD       Table A.2.3.2.1.1       10 - 20       QPSK       1/3       30       2.1         TDD       Table A.2.3.2.1.1       10 - 20       QPSK       1/3       30       2.1									
TDD       Table A.2.3.2.1.1       1.4.20       QPSK       1/3       3       ≥ 1         TDD       Table A.2.3.2.1.1       1.4.20       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.2.1.1       1.4.20       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.2.1.1       3.20       QPSK       1/3       8       ≥ 1         TDD       Table A.2.3.2.1.1       3.20       QPSK       1/3       8       ≥ 1         TDD       Table A.2.3.2.1.1       3.20       QPSK       1/3       10       ≥ 1         TDD       Table A.2.3.2.1.1       3.20       QPSK       1/3       10       ≥ 1         TDD       Table A.2.3.2.1.1       5.20       QPSK       1/3       16       ≥ 1         TDD       Table A.2.3.2.1.1       5.20       QPSK       1/3       18       ≥ 1         TDD       Table A.2.3.2.1.1       5.20       QPSK       1/3       20       ≥ 1         TDD       Table A.2.3.2.1.1       10.20       QPSK       1/3       21       21         TDD       Table A.2.3.2.1.1       10.20       QPSK       1/3       30       ≥ 1         TDD	-								
TDD       Table A.2.3.2.1.1       1.420       QPSK       1/3       6       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       6       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       6       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       9       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       16       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       16       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       2.4       2.1         TDD       Table A.2.3.2.1.1       1020       QPSK       1/3       2.1       2.1         TDD       Table A.2.3.2.1.1       1020       QPSK       1/3       3.2       2.1         TDD       Table A.2.3.2.1.1       1020       QPSK       1/3       3.6       2.1									
TDD       Table A.2.3.2.1.1       1.420       QPSK       1/3       5       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       8       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       8       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       320       QPSK       1/3       10       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       16       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       18       2.1         TDD       Table A.2.3.2.1.1       520       QPSK       1/3       20       2.1         TDD       Table A.2.3.2.1.1       10-20       QPSK       1/3       20       2.1         TDD       Table A.2.3.2.1.1       10-20       QPSK       1/3       30       2.1         TDD       Table A.2.3.2.1.1       10-20       QPSK       1/3       30       2.1         TDD       Table A.2.3.2.1.1       10-20       QPSK       1/3       30       2.1									
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TDD       Table A.2.3.2.1.1       10 - 20       QPSK       1/3       40       ≥ 1         TDD       Table A.2.3.2.1.1       10 - 20       QPSK       1/3       45       ≥ 1         TDD       Table A.2.3.2.1.1       10 - 20       QPSK       1/3       48       ≥ 1         TDD       Table A.2.3.2.1.1       15 - 20       QPSK       1/3       50       ≥ 1         TDD       Table A.2.3.2.1.1       15 - 20       QPSK       1/3       54       ≥ 1         TDD       Table A.2.3.2.1.1       15 - 20       QPSK       1/4       60       ≥ 1         TDD       Table A.2.3.2.1.1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1.1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1.1       20       QPSK       1/4       72       ≥ 1         TDD       Table A.2.3.2.1.1       20       QPSK       1/5       80       ≥ 1         TDD       Table A.2.3.2.1.1       20       QPSK       1/5       81       ≥ 1         TDD       Table A.2.3.2.1.1       20       QPSK       1/6       96       ≥ 1	TDD			10 - 20	QPSK	1/3	32	≥ 1	
TDDTable A.2.3.2.1-110 · 20QPSK1/345 $\geq 1$ TDDTable A.2.3.2.1-110 · 20QPSK1/350 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/354 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/460 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 · 20QPSK1/472 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/575 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/580 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/581 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/581 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/690 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/690 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/690 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/690 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/6 $\geq 1$ TDDTable A.2.3.2.1-11.4 · 2016QAM3/41 $\geq 1$ TDDTable A.2.3.2.2-11.4 · 20 <td>TDD</td> <td>Table A.2.3.2.1-1</td> <td></td> <td>10 - 20</td> <td>QPSK</td> <td>1/3</td> <td>36</td> <td>≥ 1</td> <td></td>	TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	36	≥ 1	
TDDTable A.2.3.2.1-110 - 20QPSK1/348 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/350 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/460 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/464 $\geq 1$ TDDTable A.2.3.2.1-115 - 20QPSK1/575 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/580 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/580 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/581 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/581 $\geq 1$ TDDTable A.2.3.2.1-120QPSK1/690 $\geq 1$ TDDTable A.2.3.2.1-11.4-2016QAM3/41 $\geq 1$ TDDTable A.2.3.2.2-11.4-2016QAM3/44 $\geq 1$ TDDTable A.2.3.2.2-11.4-	TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	40	≥ 1	
TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/3       50       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/3       54       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       60       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/4       75       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       80       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD </td <td>TDD</td> <td>Table A.2.3.2.1-1</td> <td></td> <td>10 - 20</td> <td>QPSK</td> <td>1/3</td> <td>45</td> <td>≥ 1</td> <td></td>	TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	45	≥ 1	
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TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       60       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       64       ≥ 1         TDD       Table A.2.3.2.1-1       15 - 20       QPSK       1/4       72       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       75       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       80       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       81       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       81       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.2.1       1.4 - 20       16QAM       3/4       1       ≥ 1         TDD <td< td=""><td>TDD</td><td>Table A.2.3.2.1-1</td><td></td><td>15 - 20</td><td>QPSK</td><td>1/3</td><td>50</td><td>≥ 1</td><td></td></td<>	TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	50	≥ 1	
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TDD       Table A.2.3.2.1-1       20       QPSK       1/5       80       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/5       81       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       90       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.1-1       20       QPSK       1/6       96       ≥ 1         TDD       Table A.2.3.2.2-1       1.4 - 20       16QAM       3/4       1       ≥ 1         TDD       Table A.2.3.2.2-1       1.4 - 20       16QAM       3/4       3       ≥ 1         TDD       Table A.2.3.2.2-1       1.4 - 20       16QAM       3/4       4       ≥ 1         TDD       Table A.2.3.2.2-1       3 - 20       16QAM       3/4       5       ≥ 1         TDD	TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	72	≥ 1	
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TDDTable A.2.3.2.2-1 $1.4 - 20$ $16QAM$ $3/4$ $4$ $\geq 1$ TDDTable A.2.3.2.2-1 $1.4 - 20$ $16QAM$ $3/4$ $5$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $6$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $8$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $8$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $9$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $10$ $\geq 1$	TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	2	≥ 1	
TDDTable A.2.3.2.2-1 $1.4 - 20$ $16QAM$ $3/4$ $5$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $6$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $8$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $9$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $9$ $\geq 1$ TDDTable A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $10$ $\geq 1$	TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	3	≥ 1	
TDD       Table A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $6$ $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $8$ $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $8$ $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $9$ $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ $16QAM$ $3/4$ $10$ $\geq 1$	TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	4	≥ 1	
TDD       Table A.2.3.2.2-1 $3 - 20$ 16QAM $3/4$ 8 $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ 16QAM $3/4$ 9 $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ 16QAM $3/4$ 9 $\geq 1$ TDD       Table A.2.3.2.2-1 $3 - 20$ 16QAM $3/4$ 10 $\geq 1$	TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	5	≥ 1	
TDD     Table A.2.3.2.2-1     3 - 20     16QAM     3/4     9     ≥ 1       TDD     Table A.2.3.2.2-1     3 - 20     16QAM     3/4     10     ≥ 1	TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	6	≥ 1	
TDD         Table A.2.3.2.2-1         3 - 20         16QAM         3/4         10         ≥ 1	TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	8	≥ 1	
	TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	9	≥ 1	
TDD Table A.2.3.2.2-1 3 - 20 16QAM 3/4 12 ≥ 1	TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	10	≥ 1	
	TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	12	≥ 1	

TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	15	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	16	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/2	18	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/3	20	≥ 1	
TDD	Table A.2.3.2.2-1	5 - 20	16QAM	1/3	24	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	1/3	25	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	1/3	27	≥ 1	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	30	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	32	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	36	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	40	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	45	≥ 2	
TDD	Table A.2.3.2.2-1	10 - 20	16QAM	3/4	48	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	3/4	50	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	3/4	54	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	2/3	60	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	2/3	64	≥ 2	
TDD	Table A.2.3.2.2-1	15 - 20	16QAM	1/2	72	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	75	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	80	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	1/2	81	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	2/5	90	≥ 2	
TDD	Table A.2.3.2.2-1	20	16QAM	2/5	96	≥ 2	

# A.2.2 Reference measurement channels for FDD

# A.2.2.1 Full RB allocation

#### A.2.2.1.1 QPSK

#### Table A.2.2.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6
Payload size	Bits	600	1544	2216	5160	4392	4584
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
(Note 1)							
Total number of bits per Sub-Frame	Bits	1728	4320	7200	14400	21600	28800
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400
UE Category		≥1	≥1	≥1	≥1	≥1	≥1
Note 1: If more than one Code Block is	present, ar	n addition	al CRC s	equence	of L = 24	Bits is a	ttached
to each Code Block (otherwise	L = 0 Bit)						

## A.2.2.1.2 16-QAM

#### Table A.2.2.1.2-1 Reference Channels for 16-QAM with full RB allocation

Parameter	Unit			Va	lue				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12		
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM		
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3		
Payload size	Bits	2600	4264	4968	21384	21384	19848		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of code blocks per Sub-Frame (Note 1)		1	1	1	4	4	4		
Total number of bits per Sub-Frame	Bits	3456	8640	14400	28800	43200	57600		
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400		
UE Category		≥1	≥ 1	≥1	≥ 2	≥2	≥2		
Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)									

#### A.2.2.1.3 64-QAM

[FFS]

## A.2.2.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

# A.2.2.2.1 QPSK

Paramet er	Ch BW	Allocate d RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transpo rt block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Categor y
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	≥1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	≥1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	≥1
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	≥1
	3-20	12	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	12	QPSK	1/3	1736	24	1	5760	2880	≥1
	5-20	24	12	QPSK	1/3	2472	24	1	6912	3456	≥1
	10-20	25	12	QPSK	1/3	2216	24	1	7200	3600	≥1
	10-20	27	12	QPSK	1/3	2792	24	1	7776	3888	≥1
	10-20	30	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
	20	96	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

# Table A.2.2.2.1-1 Reference Channels for QPSK with partial RB allocation

## A.2.2.2.2 16-QAM

Paramet er	Ch BW	Allocate d RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transpo rt block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Categoi y
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	12	16QAM	3/4	1736	24	1	2304	576	≥1
	1.4 - 20	5	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	12	16QAM	3/4	3880	24	1	5184	1296	≥1
	3-20	10	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	12	16QAM	1/3	4008	24	1	11520	2880	≥1
	5-20	24	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	12	16QAM	2/3	23688	24	4	34560	8640	≥2
	15 - 20	64	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	12	16QAM	1/2	21384	24	4	43200	10800	≥2
	20	80	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	12	16QAM	1/2	22920	24	4	46656	11664	≥2
	20	90	12	16QAM	2/5	20616	24	4	51840	12960	≥2
	20	96	12	16QAM	2/5	22152	24	4	55296	13824	≥2

#### Table A.2.2.2.2-1 Reference Channels for 16-QAM with partial RB allocation

#### A.2.2.2.3 64-QAM

[FFS]

A.2.2.3 Void

Table A.2.2.3-1: Void

# A.2.3 Reference measurement channels for TDD

For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL:2UL.

# A.2.3.1 Full RB allocation

## A.2.3.1.1 QPSK

Parameter										
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks		6	15	25	50	75	100			
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1			
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12			
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK			
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6			
Payload size										
For Sub-Frame 2,3,7,8	Bits	600	1544	2216	5160	4392	4584			
Transport block CRC	Bits	24	24	24	24	24	24			
Number of code blocks per Sub-Frame										
(Note 1)										
For Sub-Frame 2,3,7,8		1	1	1	1	1	1			
Total number of bits per Sub-Frame										
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	14400	21600	28800			
Total symbols per Sub-Frame										
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400			
UE Category		≥ 1	≥ 1	≥1	≥ 1	≥1	≥ 1			
Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached										
to each Code Block (otherwise L = 0 Bit)										
Note 2: As per Table 4.2-2 in TS 36.21	1 [4]									

## A.2.3.1.2 16-QAM

Table A.2.3.1.2-1 Reference Channels for 16-QAM with full RB allocation

Parameter Unit Value									
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1		
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12		
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM		
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3		
Payload size									
For Sub-Frame 2,3,7,8	Bits	2600	4264	4968	21384	21384	19848		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of code blocks per Sub-Frame									
(Note 1)									
For Sub-Frame 2,3,7,8		1	1	1	4	4	4		
Total number of bits per Sub-Frame									
For Sub-Frame 2,3,7,8	Bits	3456	8640	14400	28800	43200	57600		
Total symbols per Sub-Frame									
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400		
UE Category		≥ 1	≥ 1	≥ 1	≥ 2	≥2	≥2		
Note 1:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)         Note 2:       As per Table 4.2-2 in TS 36.211 [4]									

#### A.2.3.1.3 64-QAM

[FFS]

# A.2.3.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

#### A.2.3.2.1 QPSK

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	≥1
	1.4 - 20	5	1	12	QPSK	1/3 1/3	424	24	1	1440	720	≥1
	3-20	6	1	12	QPSK		600	24	1	1728	864	≥1
	3-20 3-20	8	1	12 12	QPSK QPSK	1/3 1/3	808 776	24 24	1	2304 2592	1152 1296	≥1
	3-20	9 10	1	12	QPSK	1/3	872	24	1	2592	1296	≥ 1 ≥ 1
	3-20	10	1	12	QPSK	1/3	1224	24	1	3456	1728	≥1
	5-20	15	1	12	QPSK	1/3	1320	24	1	4320	2160	≥1
	5-20	16	1	12	QPSK	1/3	1384	24	1	4608	2304	≥1
	5-20	18	1	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	1	12	QPSK	1/3	1736	24	1	5760	2880	≥1
	5-20	24	1	12	QPSK	1/3	2472	24	1	6912	3456	≥1
	10-20	25	1	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	1	12	QPSK	1/3	2792	24	1	7776	3888	≥ 1
	10-20	30	1	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	1	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	1	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	1	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
-	10-20	45	1	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	1	12	QPSK	1/3	4264	24	1	13824	6912	≥1
	15 - 20	50	1	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	1	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	1	12	QPSK	1/4	4264	24	1	17280	8640	≥1
	15 - 20	64	1	12	QPSK	1/4	4584	24	1	18432	9216	≥1
	15 - 20	72	1	12	QPSK	1/4	5160	24	1	20736	10368	≥1
	20 20	75 80	1	12 12	QPSK QPSK	1/5 1/5	4392 4776	24 24	1	21600 23040	10800 11520	≥1 ≥1
	20	80	1	12	QPSK	1/5	4776	24	1	23040	11664	≥ 1
	20	90	1	12	QPSK	1/5	4008	24	1	25920	12960	≥ 1
	20	90	1	12	QPSK	1/6	4008	24	1	27648	13824	≥1
Note 1: Note 2:	If more t	han one Co		resent, an a					ed to each C			

## A.2.3.2.2 16-QAM

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	1	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	1	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	1	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	1	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	1	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	1	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	1	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	1	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	1	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	1	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	1	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	1	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	1	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	1	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	1	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	1	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	1	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	1	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	1	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	1	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	1	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	1	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	1	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54 60	1	12 12	16QAM	3/4	22920	24 24	4	31104	7776	≥2
	15 - 20		1		16QAM	2/3	23688	24	4	34560	8640	≥2
	<u>15 - 20</u> 15 - 20	64 72	1	12 12	16QAM 16QAM	2/3 1/2	25456 20616		4	36864 41472	9216 10368	≥2 ≥2
	20	72	1	12	16QAM 16QAM	1/2	20616	24 24	4 4	41472	10368	≥2
	20	80	1	12	16QAM 16QAM	1/2	21384	24	4	43200	11520	≥ 2
	20	80	1	12	16QAM	1/2	22920	24	4	46080	11664	≥2
	20	90	1	12	16QAM	2/5	22920	24	4	51840	12960	≥2
	20	90	1	12	16QAM	2/5	20010	24	4	55296	13824	≥2
Note 1: Note 2:	If more the	han one Coo	de Block is p n TS 36.211	resent, an a								

#### Table A.2.3.2.2-1 Reference Channels for 16QAM with partial RB allocation

A.2.3.2.3 64-QAM

[FFS]

A.2.3.3 Void

Table A.2.3.3-1: Void

# A.3 DL reference measurement channels

# A.3.1 General

The number of available channel bits varies across the sub-frames due to PBCH and PSS/SSS overhead. The payload size per sub-frame is varied in order to keep the code rate constant throughout a frame.

No user data is scheduled on subframes #5 in order to facilitate the transmission of system information blocks (SIB).

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{\text{RB}}$ 

- 1. Calculate the number of channel bits  $N_{ch}$  that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, if C = 1\\ C, if C > 1 \end{cases}$$
 subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{\text{RB}}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].

3. If there is more than one *A* that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

4. For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL+DwPTS (12 OFDM symbol): 2UL

## A.3.1.1 Overview of DL reference measurement channels

In Table A.3.1.1-1 are listed the DL reference measurement channels specified in annexes A.3.2 to A.3.10 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.3.2 to A.3.10 as appropriate.

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD, Rece	eiver requirements				•				
FDD	Table A.3.2-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.2-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.2-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.2-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.2-1		15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.2-1		20	QPSK	1/3	100		≥ 1	
TDD, Rece	eiver requirements			-	_			-	
TDD	Table A.3.2-2		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.2-2		3	QPSK	1/3	15		≥ 1	
TDD	Table A.3.2-2		5	QPSK	1/3	25		≥ 1	
TDD	Table A.3.2-2		10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.2-2		15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.2-2		20	QPSK	1/3	100		≥ 1	
FDD, Rece	eiver requirements,	Maximum inp	out level	for UE Ca	tegorie	s ≥ 3			
FDD	Table A.3.2-3		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3		10	64QAM	3/4	50		-	
FDD	Table A.3.2-3		15	64QAM	3/4	75		-	
FDD	Table A.3.2-3		20	64QAM	3/4	100		-	
FDD, Rece	eiver requirements,	Maximum inp	out level	for UE Ca	tegorie	s 1			
FDD	Table A.3.2-3a		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3a		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3a		5	64QAM	3/4	18		-	
FDD	Table A.3.2-3a		10	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		15	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		20	64QAM	3/4	17		-	
	eiver requirements,	Maximum inp	1	1	tegorie	s 2		-	
FDD	Table A.3.2-3b		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3b		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3b		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3b		10	64QAM	3/4	50		-	
FDD	Table A.3.2-3b		15	64QAM	3/4	75		-	
FDD	Table A.3.2-3b		20	64QAM	3/4	83		-	
	eiver requirements,	Maximum inp	1			1			
TDD	Table A.3.2-4		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4		5	64QAM	3/4	25		-	
TDD	Table A.3.2-4		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4		15	64QAM	3/4	75		-	
TDD	Table A.3.2-4		20	64QAM	3/4	100		-	
	eiver requirements,	Maximum inp	1	1	_	1			
TDD	Table A.3.2-4a		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4a		3	64QAM	3/4	15		-	

Table A.3.1.1-1: Overview of DL reference measurement channels

	[			1	1	[			[
TDD	Table A.3.2-4a		5	64QAM	3/4	18		-	
TDD	Table A.3.2-4a		10	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		15	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		20	64QAM	3/4	17		-	
TDD, Rece	eiver requirements,	Maximum inp	ut level	for UE Ca	tegorie	s 2		-	Γ
TDD	Table A.3.2-4b		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4b		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4b		5	64QAM	3/4	25		-	
TDD	Table A.3.2-4b		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4b		15	64QAM	3/4	75		-	
TDD	Table A.3.2-4b		20	64QAM	3/4	83		-	
FDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	(S)	T			-
FDD	Table A.3.3.1-1	R.4 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.1-1	R.42 FDD	20	QPSK	1/3	100		≥ 1	
FDD	Table A.3.3.1-1	R.2 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.1-2	R.3-1 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.1-2	R.3 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.1-3	R.5 FDD	3	64QAM	3/4	15		≥ 1	
FDD	Table A.3.3.1-3	R.6 FDD	5	64QAM	3/4	25		≥ 2	
FDD	Table A.3.3.1-3	R.7 FDD	10	64QAM	3/4	50		≥ 2	
FDD	Table A.3.3.1-3	R.8 FDD	15	64QAM	3/4	75		≥ 2	
FDD	Table A.3.3.1-3	R.9 FDD	20	64QAM	3/4	100		≥ 3	
FDD	Table A.3.3.1-3a	R.6-1 FDD	5	64QAM	3/4	18		≥ 1	
FDD	Table A.3.3.1-3a	R.7-1 FDD	10	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.8-1 FDD	15	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-1 FDD	20	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-2 FDD	20	64QAM	3/4	83		≥ 2	
FDD	Table A.3.3.1-6	R.41 FDD	10	QPSK	1/10	50		≥ 1	
FDD, PDS	CH Performance, S	ingle-antenna	transm	ission (CR	S), Sin	gle PR	B (Cha	nnel e	edge)
FDD	Table A.3.3.1-4	R.0 FDD	3	16QAM	1/2	1		≥ 1	
FDD	Table A.3.3.1-4	R.1 FDD	10 / 20	16QAM	1/2	1		≥ 1	
FDD, PDS	CH Performance, S	ingle-antenna		ission (CR	S), Sin	gle PR	B (MB	SFN C	onfiguration)
FDD	Table A.3.3.1-5	R.29 FDD	10	16QAM	1/2	1		≥ 1	
FDD, PDS	CH Performance: C	arrier aggrega	ation wit	th power i	mbalan	се			
FDD	Table A.3.3.1-7	R.49 FDD	20	64QAM	0.84-	100		≥5	
	CH Performance: C				0.87			, , , , , , , , , , , , , , , , , , ,	
FDD, FD3	Table A.3.3.2.1-3	R.60 FDD	10	64QAM	Alber	50		≥ 3	
	CH Performance, N						a nort	-	<u> </u>
FDD, FDS	Table A.3.3.2.1-1	R.10 FDD	10	QPSK	1/3	50	a port	<b>5</b> ≥1	
FDD	Table A.3.3.2.1-1	R.11 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-2 FDD	5	16QAM	1/2	25		≥ 2 ≥ 1	
FDD	Table A.3.3.2.1-1	R.11-2 FDD R.11-3 FDD	10	16QAM	1/2	40		≥ 1 ≥ 1	
FDD	Table A.3.3.2.1-1	R.11-3 FDD R.11-4 FDD	10	QPSK	1/2	40 50		≥ 1 ≥ 1	
FDD	Table A.3.3.2.1-1	R.30 FDD	20	16QAM	1/2	100		≥ 1 ≥ 2	
FDD	Table A.3.3.2.1-1	R.30-1 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.1-1	R.35 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-1 FDD		64QAM	0.39	100			
FDD	Table A.3.3.2.1-1 Table A.3.3.2.1-1	R.35-1 FDD R.35-2 FDD	20 15	64QAM 64QAM	0.39	75		4 ≥ 2	
FUU	TADIE A.3.3.2.1-1	R.39-2 FUU	GI	04QAIVI	0.39	10		< Z	

FDD	Table A.3.3.2.1-1	R.35-3 FDD	10	64QAM	0.39	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-4 FDD	10	64QAM	0.39	50		≥ 2 ≥ 2	
FDD	Table A.3.3.2.1-2	R.46 FDD	10	QPSK	0.47	50		² 2 ≥ 1	
FDD	Table A.3.3.2.1-2	R.40 FDD	10	16QAM		50		≥ 1 ≥ 1	
	CH Performance, N						no norte		
			1	QPSK	-	1	na port		
FDD	Table A.3.3.2.2-1	R.12 FDD	1.4		1/3	6		≥ 1	
FDD	Table A.3.3.2.2-1	R.13 FDD	10	QPSK	1/3	50		≥1	
FDD	Table A.3.3.2.2-1	R.14 FDD	10	16QAM	1/2	50		≥2	
FDD	Table A.3.3.2.2-1	R.14-1 FDD	10	16QAM	1/2	6		≥1	
FDD	Table A.3.3.2.2-1	R.14-2 FDD	10	16QAM	1/2	3		≥1	
FDD	Table A.3.3.2.2-1	R.14-3 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.2-1	R.36 FDD	10	64QAM	1/2	50		≥ 2	
	CH Performance (U			-	-				
FDD	Table A.3.3.3.1-1	R.51 FDD	10	16QAM	1/2	50		≥2	
	CH Performance (U			-	· ·	-	on Qua		located)
FDD	Table A.3.3.3.1-2	R.52 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.53 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.54 FDD	10	16QAM	1/2	50		≥ 2	
	CH Performance (U			-	-	-			
FDD	Table A.3.3.3.2-1	R.43 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.50 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.44 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-2	R.45 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.45-1 FDD	10	16QAM	1/2	39		≥ 1	
FDD	Table A.3.3.3.2-1	R.48 FDD	10	QPSK		50		≥ 1	
	CH Performance, S		transmi	•		1			
TDD	Table A.3.4.1-1	R.4 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.1-1	R.42 TDD	20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.4.1-1	R.2 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.1-2	R.3-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.1-2	R.3 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.1-3	R.5 TDD	3	64QAM	3/4	15		≥ 1	
TDD	Table A.3.4.1-3	R.6 TDD	5	64QAM	3/4	25		≥ 2	
TDD	Table A.3.4.1-3	R.7 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.1-3	R.8 TDD	15	64QAM	3/4	75		≥ 2	
TDD	Table A.3.4.1-3	R.9 TDD	20	64QAM	3/4	100		≥ 3	
TDD	Table A.3.4.1-3a	R.6-1 TDD	5	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.1-3a	R.7-1 TDD	10	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.8-1 TDD	15	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-1 TDD	20	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-2 TDD	20	64QAM	3/4	83		≥ 2	
TDD	Table A.3.4.1-6	R.41 TDD	10	QPSK	1/10	50		≥ 1	
TDD, PDS	CH Performance, S	ingle-antenna	transmi	ission (CR	S), Sin	gle PR	B (Cha	nnel e	dge)
TDD	Table A.3.4.1-4	R.0 TDD	3	16QAM	1/2	1		≥ 1	
TDD	Table A.3.4.1-4	R.1 TDD	10 / 20	16QAM	1/2	1		≥ 1	
TDD, PDS	CH Performance, S	ingle-antenna		ission (CR	S), Sin	gle PR	B (MBS	FN C	onfiguration)
TDD	Table A.3.4.1-5	R.29 TDD	10	16QAM	1/2	1		≥ 1	
	CH Performance: C		-		L	L			

TDD, PDSC TDD TDD TDD TDD		R.49 TDD	20	64QAM	0.81- 087	100		≥ 5	
TDD TDD	H Performance, M	lulti-antenna t	ransmis	sion (CRS		antenr	na nort	5	
TDD	Table A.3.4.2.1-1	R.10 TDD	10	QPSK	1/3	50		<b>∪</b> ≥1	
	Table A.3.4.2.1-1	R.11 TDD	10	16QAM	1/2	50		≥ 2	
	Table A.3.4.2.1-1	R.11-1 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.11-2 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.2.1-1	R.11-3 TDD	10	16QAM	1/2	40		 ≥ 1	
TDD	Table A.3.4.2.1-1	R.11-4 TDD	10	QPSK	1/2	50		 ≥ 1	
TDD	Table A.3.4.2.1-1	R.30 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-1 TDD	20	16QAM	1/2	100		≥ 2	
TDD	Table A.3.4.2.1-1	R.30-2 TDD	20	16QAM	1/2	100		3	
TDD	Table A.3.4.2.1-1	R.35 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.1-1	R.35-1 TDD	20	64QAM	0.39	100		4	
TDD	Table A.3.4.2.1-2	R.35-2 TDD	10	64QAM	0.47	50		≥ 2	
TDD	Table A.3.4.2.1-2	R.46 TDD	10	QPSK	0.11	50		 ≥ 1	
TDD	Table A.3.4.2.1-2	R.47 TDD	10	16QAM		50		≥ 1	
	CH Performance, M				) Four		na nor		
TDD	Table A.3.4.2.2-1	R.12 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.2.2-1	R.13 TDD	10	QPSK	1/3	50		 ≥ 1	
TDD	Table A.3.4.2.2-1	R.14 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.2.2-1	R.14-1 TDD	10	16QAM	1/2	6		 ≥ 1	
TDD	Table A.3.4.2.2-1	R.14-2 TDD	10	16QAM	1/2	3		_ · ≥ 1	
TDD	Table A.3.4.2.2-1	R.43 TDD	20	16QAM	1/2	100		_   ≥2	
TDD	Table A.3.4.2.2-1	R.36 TDD	10	64QAM	1/2	50		≥ 2	
	H Performance, S		-		172	00			
TDD	Table A.3.4.3.1-1	R.25 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.1-1	R.26 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.26-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.3.1-1	R.27 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.27-1 TDD	10	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.3.1-1	R.28 TDD	10	16QAM	1/2	1		≥ 1	
	H Performance, T								
TUD. PUSC	Table A.3.4.3.2-1	R.31 TDD	10	QPSK	1/3	50		≥ 1	
TDD, PDSC									
-	Table A.3.4.3.2-1	R.32 TDD	10	16QAM	1/2	50		≥ 2	
TDD TDD		R.32 TDD R.32-1 TDD	10 5	16QAM 16QAM	1/2 1/2			≥ 2 ≥ 1	
TDD	Table A.3.4.3.2-1 Table A.3.4.3.2-1 Table A.3.4.3.2-1	R.32 TDD R.32-1 TDD R.33 TDD		16QAM 16QAM 64QAM		50 [25] 50			
TDD TDD TDD	Table A.3.4.3.2-1	R.32-1 TDD	5	16QAM	1/2	[25]		≥ 1	
TDD TDD TDD TDD TDD	Table A.3.4.3.2-1 Table A.3.4.3.2-1	R.32-1 TDD R.33 TDD	5 10	16QAM 64QAM	1/2 3/4	[25] 50		≥ 1 ≥ 2	
TDD TDD TDD TDD TDD TDD TDD	Table A.3.4.3.2-1           Table A.3.4.3.2-1           Table A.3.4.3.2-1	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD	5 10 10 10	16QAM 64QAM 64QAM 64QAM	1/2 3/4 3/4 1/2	[25] 50 [18] 50		≥ 1 ≥ 2 ≥ 1	
TDD TDD TDD TDD TDD TDD TDD	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD	5 10 10 10	16QAM 64QAM 64QAM 64QAM	1/2 3/4 3/4 1/2	[25] 50 [18] 50		≥ 1 ≥ 2 ≥ 1	
TDD TDD TDD TDD TDD TDD <b>TDD, PDSC</b> TDD	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         CH Performance (U)	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD	5 10 10 10 <b>) Two ar</b> 10	16QAM 64QAM 64QAM 64QAM <b>16QAM</b>	1/2 3/4 3/4 1/2 ts (CSI 1/2	[25] 50 [18] 50 - <b>RS)</b> 50	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2	located)
TDD TDD TDD TDD TDD TDD <b>TDD, PDSC</b> TDD	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1 <b>Table A.3.4.3.2-1 Table A.3.4.3.2-1</b>	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD	5 10 10 10 <b>) Two ar</b> 10	16QAM 64QAM 64QAM 64QAM <b>16QAM</b>	1/2 3/4 3/4 1/2 ts (CSI 1/2	[25] 50 [18] 50 - <b>RS)</b> 50	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2	located)
TDD TDD TDD TDD TDD TDD TDD, PDSC TDD, PDSC	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1 <b>CH Performance (U</b> )         Table A.3.4.3.3-1 <b>CH Performance (U</b> )	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD <b>E specific RS</b>	5 10 10 10 <b>Two ar</b> 10 <b>Two ar</b>	16QAM 64QAM 64QAM 64QAM <b>16QAM</b> 16QAM	1/2 3/4 3/4 1/2 ts (CSI 1/2 ts (CSI	[25] 50 [18] 50 -RS) -RS, no	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2 ≥ 2 asi Co-	located)
TDD TDD TDD TDD TDD TDD <b>TDD, PDSC</b> TDD, <b>PDSC</b> TDD, <b>PDSC</b>	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         CH Performance (U)         Table A.3.4.3.3-1         CH Performance (U)         Table A.3.4.3.3-2	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD <b>E specific RS</b> R.52 TDD	5 10 10 10 <b>) Two ar</b> 10 <b>) Two ar</b> 10	16QAM 64QAM 64QAM 64QAM 16QAM 16QAM 16QAM	1/2 3/4 3/4 1/2 ts (CSI 1/2 ts (CSI 1/2	[25] 50 [18] 50 -RS) 50 -RS, no 50	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2 ≥ 2 ssi Co- ≥ 2	located)
TDD       TDD       TDD       TDD       TDD, PDSC       TDD, PDSC       TDD, PDSC       TDD       TDD, TDD       TDD, PDSC	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1 <b>CH Performance (U</b> Table A.3.4.3.3-1 <b>CH Performance (U</b> Table A.3.4.3.3-2         Table A.3.4.3.3-2         Table A.3.4.3.3-2	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD <b>E specific RS</b> R.52 TDD R.53 TDD R.54 TDD	5 10 10 <b>10</b> <b>Two ar</b> 10 <b>Two ar</b> 10 10 10	16QAM 64QAM 64QAM 64QAM 16QAM 16QAM 64QAM 16QAM	1/2 3/4 1/2 ts (CSI 1/2 ts (CSI 1/2 1/2 1/2	[25] 50 [18] 50 <b>-RS)</b> 50 50 50 50	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2	located)
TDD       TDD       TDD       TDD       TDD, PDSC       TDD, PDSC       TDD, PDSC       TDD       TDD, TDD       TDD, PDSC	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1 <b>CH Performance (U</b> )         Table A.3.4.3.3-1 <b>CH Performance (U</b> )         Table A.3.4.3.3-2         Table A.3.4.3.3-2         Table A.3.4.3.3-2         Table A.3.4.3.3-2         Table A.3.4.3.3-2	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD <b>E specific RS</b> R.51 TDD <b>E specific RS</b> R.52 TDD R.53 TDD R.54 TDD	5 10 10 <b>10</b> <b>Two ar</b> 10 <b>Two ar</b> 10 10 10	16QAM 64QAM 64QAM 64QAM 16QAM 16QAM 64QAM 16QAM	1/2 3/4 1/2 ts (CSI 1/2 ts (CSI 1/2 1/2 1/2	[25] 50 [18] 50 <b>-RS)</b> 50 50 50 50	on Qua	≥ 1 ≥ 2 ≥ 1 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2 ≥ 2	located)
TDD       TDD       TDD       TDD       TDD       TDD, PDSC       TDD, PDSC       TDD       TDD, PDSC       TDD       TDD, PDSC       TDD       TDD, PDSC       TDD       TDD, PDSC	Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         Table A.3.4.3.2-1         CH Performance (U         Table A.3.4.3.3-1         CH Performance (U         Table A.3.4.3.3-2         Table A.3.4.3.3-2	R.32-1 TDD R.33 TDD R.33-1 TDD R.34 TDD E specific RS R.51 TDD E specific RS R.52 TDD R.53 TDD R.54 TDD E specific RS	5 10 10 <b>10</b> <b>Two ar</b> 10 <b>Two ar</b> 10 10 10 10 <b>Four a</b>	16QAM 64QAM 64QAM 64QAM 16QAM 16QAM 64QAM 16QAM	1/2 3/4 1/2 ts (CSI 1/2 ts (CSI 1/2 1/2 1/2 tts (CS	[25] 50 [18] 50 -RS) -RS, no 50 50 50 50	on Qua	$\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 2$ $asi Co-$ $\geq 2$ $\geq 2$ $\geq 2$ $\geq 2$	located)

TDD	Table A.3.4.3.5-1	R.50 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.5-2	R.45 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.5-2	R.45-1 TDD	10	16QAM	1/2	39		 ≥1	
	CH / PCFICH Perfo			10 co ini	.,,_				
FDD	Table A.3.5.1-1	R.15 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.15-1 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.15-2 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.17 FDD	5	PDCCH					
TDD, PDC	CH / PCFICH Perfo	rmance			1				
TDD	Table A.3.5.2-1	R.15 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.15-1 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.15-2 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.17 TDD	5	PDCCH					
FDD / TDD	, PHICH Performar	nce							
FDD / TDD	Table A.3.6-1	R.18	10	PHICH					
FDD /	Table A.3.6-1	R.19	10	РНІСН					
TDD FDD /			-	-					
	Table A.3.6-1	R.20	5	PHICH					
FDD / TDD	Table A.3.6-1	R.24	10	PHICH					
	, PBCH Performan	се		r	[		1	F	
FDD / TDD	Table A.3.7-1	R.21	1.4	QPSK	40/ 1920				
FDD / TDD	Table A.3.7-1	R.22	1.4	QPSK	40/ 1920				
FDD / TDD	Table A.3.7-1	R.23	1.4	QPSK	40/ 1920				
	H Performance								
FDD	Table A.3.8.1-1	R.40 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.8.1-1	R.37 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.8.1-2	R.38 FDD	10	16QAM	1/2	50		≥ 1	
FDD	Table A.3.8.1-3	R.39-1 FDD	5	64QAM	2/3	25		≥ 1	
FDD	Table A.3.8.1-3	R.39 FDD	10	64QAM	2/3	50		≥ 2	
TDD, PMC	H Performance								
TDD	Table A.3.8.2-1	R.40 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.8.2-1	R.37 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.8.2-2	R.38 TDD	10	16QAM	1/2	50		≥ 1	
TDD	Table A.3.8.2-3	R.39-1 TDD	5	64QAM	2/3	25		≥ 1	
TDD	Table A.3.8.2-3	R.39 TDD	10	64QAM	2/3	50		≥ 2	
-	ained data rate (CR	-							
FDD	Table A.3.9.1-1	R.31-1 FDD	10	64QAM	0.40 0.59-			≥ 1	
FDD	Table A.3.9.1-1	R.31-2 FDD	10	64QAM	0.64			≥ 2	
FDD	Table A.3.9.1-1	R.31-3 FDD	20	64QAM	0.59- 0.62			≥ 2	
FDD	Table A.3.9.1-1	R.31-3A FDD	10	64QAM	0.85- 0.90			≥ 2	
FDD	Table A.3.9.1-1	R.31-3C FDD	15	64QAM	0.87- 0.91			≥ 3	
FDD	Table A.3.9.1-1	R.31-4 FDD	20	64QAM	0.87- 0.90			≥ 3	
FDD	Table A.3.9.1-1	R.31-4B FDD	15	64QAM	0.85- 0.88			≥ 4	

<u> </u>				r	0.85-		
FDD	Table A.3.9.1-1	R.31-5 FDD	15	64QAM	0.00-	≥ 3	
TDD, Sus	tained data rate (CF	,		•			
TDD	Table A.3.9.2-1	R.31-1 TDD	10	64QAM	0.40	 ≥ 1	
TDD	Table A.3.9.2-1	R.31-2 TDD	10	64QAM	0.59- 0.64	≥ 2	
TDD	Table A.3.9.2-1	R.31-3 TDD	20	64QAM	0.59- 0.62	≥ 2	
TDD	Table A.3.9.2-1	R.31-3A TDD	15	64QAM	0.87- 0.90	≥ 2	
TDD	Table A.3.9.2-1	R.31-4 TDD	20	64QAM	0.87- 0.90	≥ 3	
FDD, Sus	tained data rate tes	t with EPDCCI	H sched	uling (CRS	-		
FDD	Table A.3.9.3-1	R.31E-1 FDD	10	64QAM	0.40- 0.41	≥ 1	
FDD	Table A.3.9.3-1	R.31E-2 FDD	10	64QAM	0.59- 0.66	≥ 2	
FDD	Table A.3.9.3-1	R.31E-3 FDD	20	64QAM	0.59- 0.63	≥ 2	
FDD	Table A.3.9.1-1	R.31E-3C FDD	15	64QAM	0.87- 0.92	≥ 3	
FDD	Table A.3.9.3-1	R.31E-3A FDD	10	64QAM	0.85- 0.92	≥2	
FDD	Table A.3.9.3-1	R.31E-4 FDD	20	64QAM	0.87- 0.91	≥ 3	
FDD	Table A.3.9.1-1	R.31E-4B FDD	15	64QAM	0.87- 0.90	≥ 4	
TDD, Sus	tained data rate tes	t with EPDCCI	H sched	uling (CRS	5)		
TDD	Table A.3.9.4-1	R.31E-1 TDD	10	64QAM	0.40- 0.41	≥ 1	
TDD	Table A.3.9.4-1	R.31E-2 TDD	10	64QAM	0.59- 0.65	≥ 2	
TDD	Table A.3.9.4-1	R.31E-3 TDD	20	64QAM	0.59- 0.63	≥ 2	
TDD	Table A.3.9.4-1	R.31E-3A TDD	15	64QAM	0.87- 0.92	≥ 2	
TDD	Table A.3.9.4-1	R.31E-4 TDD	20	64QAM	0.87- 0.90	≥ 3	
FDD, ePD	CCH performance						
FDD	Table A.3.10.1-1	R.55 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.56 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.57 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.58 FDD	10	EPDCC H			
FDD	Table A.3.10.1-1	R.59 FDD	10	EPDCC H			
TDD, ePD	CCH performance						
TDD	Table A.3.10.2-1	R.55 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.56 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.57 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.58 TDD	10	EPDCC H			
TDD	Table A.3.10.2-1	R.59 TDD	10	EPDCC H			
I	1	1	I	1 1		1	

# A.3.2 Reference measurement channel for receiver characteristics

Tables A.3.2-1 and A.3.2-2 are applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4 (Maximum input level).

Tables A.3.2-3, A.3.2-3a, A.3.2-3b, A.3.2-4, A.3.2-4a and A.3.2-4b are applicable for subclause 7.4 (Maximum input level).

Tables A.3.2-1 and A.3.2-2 also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

Parameter	Unit			Va	lue				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
Subcarriers per resource block		12	12	12	12	12	12		
Allocated subframes per Radio Frame		9	9	9	9	9	9		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3		
Number of HARQ Processes	Processes	8	8	8	8	8	8		
Maximum number of HARQ transmissions		1	1	1	1	1	1		
Information Bit Payload per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1320	2216	4392	6712	8760		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	152	872	1800	4392	6712	8760		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of Code Blocks per Sub-Frame									
(Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	2	2		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	1	1	1	1	2	2		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3780	6300	13800	20700	27600		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	528	2940	5460	12960	19860	26760		
Max. Throughput averaged over 1 frame	kbps	341.6	1143.	1952.	3952.	6040.	7884		
			2	8	8	8			
UE Category		≥1	≥1	≥1	≥1	≥1	≥1		
Note 1: 2 symbols allocated to PDCCH fo						bols allo	cated to		
PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz									
Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]									
Note 3: If more than one Code Block is pr		tional CR	C seque	nce of L =	= 24 Bits	is attache	ed to		
each Code Block (otherwise L = 0	Bit)								

Table A.3.2-1: Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		408	1320	2216	4392	6712	8760
For Sub-Frame 1, 6		N/A	968	1544	3240	4968	6712
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		208	1064	1800	4392	6712	8760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	2	2
For Sub-Frame 1, 6         N/A         1         1         1         2							
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	2	2
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		1368	3780	6300	13800	20700	27600
For Sub-Frame 1, 6		N/A	3276	5556	11256	16956	22656
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		672	3084	5604	13104	20004	26904
Max. Throughput averaged over 1 frame	kbps	102.4	564	932	1965.	3007.	3970.
					6	2	4
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1
Note 1:       For normal subframes(0,4,5,9), 2 s         channel BW; 3 symbols allocated       for 1.4 MHz. For special subframe         Note 2:       For 1.4MHz, no data shall be sche         insufficient PDCCH performance         Note 3:       Reference signal, Synchronization         Note 4:       If more than one Code Block is pre-         each Code Block (otherwise L = 0         Note 5:       As per Table 4.2-2 in TS 36.211 [4]	to PDCCH for (1&6), only 2 eduled on spec signals and F esent, an addi Bit).	5 MHz a OFDM sy cial subfra PBCH allo	nd 3 MHz ymbols a ames(1&0 ocated as	z; 4 symb re allocat 6) to avoi per TS 3	ols alloca ed to PD d probler 86.211 [4]	ated to PI CCH for a ns with	DCCH all BWs.

## Table A.3.2-2: Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	61664
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	61664
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	11
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	82800
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	55498
Note 1:         2 symbols allocated to PDCCH for for 5 MHz and 3 MHz. 4 symbols a Note 2:           Reference signal, Synchronization	allocated to PE	DCCH for 1	.4 MHz.		•	llocated to	PDCCH

#### Table A.3.2-3: Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (FDD)

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

#### Table A.3.2-3a: Fixed Reference Channel for Maximum input level for UE Category 1 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	18	17	17	17
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	10296	10296	10296	10296
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	8248	10296	10296	10296
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	2	2	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2	2	2	2
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	13608	14076	14076	14076
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	11088	14076	14076	14076
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	9079.6	9266.4	9266.4	9266.4
Note 1: 2 symbols allocated to PDCCH fo	r 20 MHz, 15 M	MHz and 10	) MHz chai	nnel BW. 3	symbols a	llocated to	PDCCH
for 5 MHz and 3 MHz. 4 symbols							
Note 2: Reference signal, Synchronization	n signals and F	PBCH alloc	ated as pe	r TS 36.21	1 [4].		
Note 3: If more than one Code Block is pr	esent, an addi	tional CRC	sequence	of $L = 24 F$	Bits is attac	hed to eac	h Code

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Parameter	Unit			Va	lue			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	83	
Subcarriers per resource block		12	12	12	12	12	12	
Allocated subframes per Radio Frame		8	9	9	9	9	9	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	
Number of HARQ Processes	Processes	8	8	8	8	8	8	
Maximum number of HARQ transmissions		1	1	1	1	1	1	
Information Bit Payload								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	51024	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	51024	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of Code Blocks per Sub-Frame								
(Note 3)								
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	9	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0		N/A	2	3	5	8	9	
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	68724	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	66204	
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	45922	
<ul> <li>Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.</li> <li>Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> </ul>								

#### Table A.3.2-3b: Fixed Reference Channel for Maximum input level for UE Category 2 (FDD)

 Note 2:
 Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

 Note 3:
 If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Parameter	Unit			Va	lue			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
Subcarriers per resource block		12	12	12	12	12	12	
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1	
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	
Number of HARQ Processes	Processes	7	7	7	7	7	7	
Maximum number of HARQ transmissions		1	1	1	1	1	1	
Information Bit Payload per Sub-Frame								
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	61664	
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	46888	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	61664	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of Code Blocks per Sub-Frame								
(Note 4)								
For Sub-Frames 4,9		1	2	3	5	8	11	
For Sub-Frames 1,6		N/A	2	2	4	6	8	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0		N/A	2	3	5	8	11	
Binary Channel Bits per Sub-Frame								
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	82800	
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	67968	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	9252	16812	39312	60012	80712	
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	27877	
Note 1: For normal subframes(0,4,5,9), 2								
3 symbols allocated to PDCCH for					OCCH for 1	.4 MHz. Fo	r special	
subframe (1&6), only 2 OFDM syr								
Note 2: For 1.4MHz, no data shall be sche	eduled on spe	cial subfrar	nes(1&6) to	o avoid pro	blems with	insufficien	t PDCCH	
performance.								
Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].								
Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code								
Block (otherwise $L = 0$ Bit).	41							
Note 5: As per Table 4.2-2 in TS 36.211 [4	¥].							

## Table A.3.2-4: Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (TDD)

Parameter	Unit			Va	lue						
Channel bandwidth	MHz	1.4	3	5	10	15	20				
Allocated resource blocks		6	15	18	17	17	17				
Subcarriers per resource block		12	12	12	12	12	12				
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1				
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2				
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM				
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4				
Number of HARQ Processes	Processes	7	7	7	7	7	7				
Maximum number of HARQ transmissions		1	1	1	1	1	1				
Information Bit Payload per Sub-Frame											
For Sub-Frames 4,9	Bits	2984	8504	10296	10296	10296	10296				
For Sub-Frames 1,6	Bits	N/A	6968	8248	7480	7480	7480				
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0	Bits	N/A	6968	8248	10296	10296	10296				
Transport block CRC	Bits	Bits 24 24 24 24 24 24									
Number of Code Blocks per Sub-Frame											
(Note 4)											
For Sub-Frames 4,9		1	2	2	2	2	2				
For Sub-Frames 1,6		N/A	2	2	2	2	2				
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0		N/A	2	2	2	2	2				
Binary Channel Bits per Sub-Frame											
For Sub-Frames 4,9	Bits	4104	11340	13608	14076	14076	14076				
For Sub-Frames 1,6		N/A	9828	11880	11628	11628	11628				
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0	Bits	N/A	9252	11520	14076	14076	14076				
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	4533.6	4584.8	4584.8	4584.8				
Note 1: For normal subframes(0,4,5,9), 2 3 symbols allocated to PDCCH for subframe (1&6), only 2 OFDM sym	5 MHz and 3	MHz; 4 sy	mbols alloc	ated to PD							
Note 2: For 1.4MHz, no data shall be sche performance.					blems with	insufficien	t PDCCH				
Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].											
Note 4: If more than one Code Block is pre	esent, an addi	tional CRC	sequence	of L = 24 E	Bits is attac	hed to eac	h Code				
Block (otherwise $L = 0$ Bit).											
Note 5: As per Table 4.2-2 in TS 36.211 [4	4].										

## Table A.3.2-4a: Fixed Reference Channel for Maximum input level for UE Category 1 (TDD)

Parameter	Unit			Va	lue						
Channel bandwidth	MHz	1.4	3	5	10	15	20				
Allocated resource blocks		6	15	25	50	75	83				
Subcarriers per resource block		12	12	12	12	12	12				
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1				
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2				
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM				
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4				
Number of HARQ Processes	Processes	7	7	7	7	7	7				
Maximum number of HARQ transmissions		1	1	1	1	1	1				
Information Bit Payload per Sub-Frame											
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	51024				
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	39232				
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	51024				
Transport block CRC	Bits	24	24	24	24	24	24				
Number of Code Blocks per Sub-Frame	of Code Blocks per Sub-Frame										
(Note 4)											
For Sub-Frames 4,9		1	2	3	5	8	9				
For Sub-Frames 1,6		N/A	2	3	5	7	7				
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0		N/A	2	3	5	8	9				
Binary Channel Bits per Sub-Frame											
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	68724				
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	56340				
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A				
For Sub-Frame 0	Bits	N/A	9252	16380	39312	60012	66636				
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	23154				
Note 1: For normal subframes(0,4,5,9), 2 s											
3 symbols allocated to PDCCH for					OCCH for 1	.4 MHz. Fo	r special				
subframe (1&6), only 2 OFDM syn											
Note 2: For 1.4MHz, no data shall be sch	eduled on spe	cial subtra	mes(1&6) t	o avoid pro	oblems with	n insufficier	nt				
PDCCH performance. Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].											
Note 4: If more than one Code Block is pre	esent, an addi		sequence	OIL = 24 E	ons is attac	ned to eac	n Code				
Block (otherwise L = 0 Bit). Note 5: As per Table 4.2.2 in TS 26 211 [/	11										
Note 5: As per Table 4.2-2 in TS 36.211 [4	+j.										

## Table A.3.2-4b: Fixed Reference Channel for Maximum input level for UE Category 2 (TDD)

# A.3.3 Reference measurement channels for PDSCH performance requirements (FDD)

# A.3.3.1 Single-antenna transmission (Common Reference Symbols)

Parameter	Unit			Va	lue		
Reference channel		R.4	R.42		R.2		
		FDD	FDD		FDD		
Channel bandwidth	MHz	1.4	20		10		
Allocated resource blocks (Note 4)		6	100		50		
Allocated subframes per Radio Frame		9	9		9		
Modulation		QPSK	QPSK		QPSK		
Target Coding Rate		1/3	1/3		1/3		
Information Bit Payload (Note 4)							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	8760		4392		
For Sub-Frame 5	Bits	N/A	N/A		N/A		
For Sub-Frame 0	Bits	152	8760		4392		
Number of Code Blocks							
(Notes 3 and 4)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2		1		
For Sub-Frame 5		N/A	N/A		N/A		
For Sub-Frame 0		1	2		1		
Binary Channel Bits (Note 4)							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	27600		13800		
For Sub-Frame 5	Bits	N/A	N/A		N/A		
For Sub-Frame 0	Bits	528	26760		12960		
Max. Throughput averaged over 1 frame	Mbps	0.342	7.884		3.953		
(Note 4)							
UE Category		≥ 1	≥ 1		≥1		
Note 1: 2 symbols allocated to PDCCH for						nbols allo	cated
to PDCCH for 5 MHz and 3 MHz;							
Note 2: Reference signal, synchronization							
Note 3: If more than one Code Block is pre		tional CR	C seque	nce of L =	: 24 Bits i	is attache	ed to
each Code Block (otherwise L = 0							
Note 4: Given per component carrier per c	odeword.						

#### Table A.3.3.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit			V	alue		
Reference channel				R.3-1	R.3		
				FDD	FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Allocated subframes per Radio Frame				9	9		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			6456	14112		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9				2	3		
For Sub-Frame 5				N/A	N/A		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			12600	27600		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			10920	25920		
Max. Throughput averaged over 1 frame	Mbps			5.738	12.586		
UE Category				≥ 1	≥2		
Note 1: 2 symbols allocated to PDCCH for	or 20 MHz, 15	MHz and	10 Mł	Iz channel	BW; 3 sym	nbols allo	ocated
to PDCCH for 5 MHz and 3 MHz;	4 symbols all	ocated to	PDCC	CH for 1.4 N	ИНz.		
Note 2: Reference signal, synchronization							
Note 3: If more than one Code Block is p		itional CR	C sec	quence of L	. = 24 Bits i	s attache	ed to
each Code Block (otherwise L = 0	) Bit).						

Table A.3.3.1-2: Fixed Reference C	Channel 16QAM R=1/2
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#### Table A.3.3.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Va	lue		
Reference channel			R.5	R.6	R.7	R.8	R.9 FDD
			FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Allocated subframes per Radio Frame			9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		8504	14112	30576	46888	61664
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		6456	12576	28336	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			2	3	5	8	11
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		11340	18900	41400	62100	82800
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	Mbps		7.449	12.547	27.294	42.046	55.498
UE Category			≥ 1	≥2	≥ 2	≥2	≥ 3
Note 1: 2 symbols allocated to PDCCH fo	r 20 MHz, 1	5 MHz and	10 MHz ch	annel BW;	3 symbols	allocated t	o PDCCH
for 5 MHz and 3 MHz; 4 symbols	allocated to	PDCCH for	r 1.4 MHz.		-		
Note 2: Reference signal, synchronization	signals and	d PBCH allo	ocated as p	er TS 36.2	11 [4].		
Note 3: If more than one Code Block is pr	esent, an ac	dditional CF	RC sequence	e of L = 24	Bits is atta	ached to ea	ich Code

Block (otherwise L = 0 Bit).

Parameter	Unit	Value					
Reference channel			R.6-1	R.7-1	R.8-1	R.9-1	R.9-2
			FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz		5	10	15	20	20
Allocated resource blocks (Note 3)			18	17	17	17	83
Allocated subframes per Radio Frame			9	9	9	9	9
Modulation			64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate			3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		10296	10296	10296	10296	51024
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		8248	10296	10296	10296	51024
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 1,2,3,4,6,7,8,9			2	2	2	2	9
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0			2	2	2	2	9
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		13608	14076	14076	14076	68724
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		11088	14076	14076	14076	66204
Max. Throughput averaged over 1 frame	Mbps		9.062	9.266	9.266	9.266	45.922
UE Category			≥ 1	≥ 1	≥ 1	≥ 1	≥ 2
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to							
PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.							
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].							
Note 3: Localized allocation started from RB #0 is applied. Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each							

 Note 3:
 Localized allocation started from RB #0 is applied.

 Note 4:
 If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Parameter	Unit	Value					
Reference channel			R.0		R.1		
			FDD		FDD		
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Allocated subframes per Radio Frame			9		9		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		224		256		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		504		552		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		504		552		
Max. Throughput averaged over 1 frame	Mbps		0.202		0.230		
UE Category			≥ 1		≥ 1		
Note 1: 2 symbols allocated to PDCCH fo	r 20 MHz, 15	MHz and	10 MHz cha	annel BW	; 3 symbols	allocate	d to
PDCCH for 5 MHz and 3 MHz; 4	symbols alloca	ated to PI	DCCH for 1.	4 MHz.	-		
Note 2: Reference signal, synchronization					211 [4].		
Note 3: If more than one Code Block is pr	esent, an add	itional CF	RC sequence	e of L = 24	4 Bits is atta	ached to	each
Code Block (otherwise $L = 0$ Bit).							

	Parameter	Unit	Value		
Reference channel			R.29 FDD		
			(MBSFN)		
Channel	Channel bandwidth		10		
Allocated	resource blocks		1		
MBSFN (	MBSFN Configuration (Note 3)		111111		
Allocated	Allocated subframes per Radio Frame		3		
Modulatio	วท		16QAM		
Target Co	oding Rate		1/2		
Informatio	on Bit Payload				
For Sub	-Frames 4,9	Bits	256		
For Sub	For Sub-Frame 5		N/A		
For Sub	For Sub-Frame 0		256		
For Sub	-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)		
Number of	of Code Blocks per Sub-Frame				
(Note 4)	(Note 4)				
For Sub	-Frames 4,9		1		
For Sub-Frame 5			N/A		
For Sub-Frame 0			1		
For Sub-Frame 1,2,3,6,7,8			0 (MBSFN)		
Binary Ch	nannel Bits Per Sub-Frame				
For Sub-Frames 4,9		Bits	552		
For Sub-Frame 5		Bits	N/A		
For Sub-Frame 0		Bits	552		
For Sub-Frame 1,2,3,6,7,8		Bits	0 (MBSFN)		
Max. Throughput averaged over 1 frame		kbps	76.8		
UE Category ≥ 1					
Note 1: 2 symbols allocated to PDCCH.					
Note 2: Reference signal, synchronization signals and PBCH					
allocated as per TS 36.211 [4].					
Note 3:					
	with 6 bits is chosen for MBSFN subframe allocation.				
Note 4:	, i i i i i i i i i i i i i i i i i i i				
	CRC sequence of $L = 24$ Bits is attached to each Code				
Block (otherwise $L = 0$ Bit).					

## Table A.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit			Va	alue				
Reference channel					R.41 FDD				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks					50				
Allocated subframes per Radio Frame					9				
Modulation					QPSK				
Target Coding Rate					1/10				
Information Bit Payload									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				1384				
For Sub-Frame 5	Bits				N/A				
For Sub-Frame 0	Bits				1384				
Number of Code Blocks per Sub-Frame									
(Note 3)									
For Sub-Frames 1,2,3,4,6,7,8,9					1				
For Sub-Frame 5					N/A				
For Sub-Frame 0					1				
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				13800				
For Sub-Frame 5	Bits				N/A				
For Sub-Frame 0	Bits				12960				
Max. Throughput averaged over 1 frame	Mbps				1.246				
UE Category					≥ 1				
Note 2: Reference signal, synchronization									
Note 3: If more than one Code Block is p	resent, an add	itional CR	C seque	nce of L	= 24 Bits is	s attache	ed to		
each Code Block (otherwise L = 0	) Bit).								

### Table A.3.3.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

	Parameter	Unit	Value			
Referenc	e channel		R.49 FDD			
Channel	bandwidth	MHz	20			
Allocated	resource blocks		100			
Allocated	subframes per Radio Frame		9			
Modulatio	วท		64QAM			
Coding R						
For Sub	-Frame 1,2,3,4,6,7,8,9,		0.84			
For Sub	-Frame 5		N/A			
For Sub	-Frame 0		0.87			
Information	on Bit Payload					
For Sub	-Frames 0,1,2,3,4,6,7,8,9	Bits	63776			
For Sub	-Frame 5	Bits	N/A			
Number ( (Note 3)	of Code Blocks per Sub-Frame					
For Sub	-Frames 0,1,2,3,4,6,7,8,9	Code Blocks	11			
For Sub	-Frame 5	Code Blocks	N/A			
Binary Cl	nannel Bits Per Sub-Frame					
For Sub	-Frames 1,2,3,4,6,7,8,9	Bits	75600			
For Sub	-Frame 5	Bits	N/A			
For Sub	-Frame 0	Bits	73080			
Max. Thr	oughput averaged over 1 frame	Mbps	57.398			
UE Categ			≥5			
Note 1:       3 symbols allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code						
	Block (otherwise $L = 0$ Bit).					

# A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

### A.3.3.2.1 Two antenna ports

Table A.3.3.2.1-1: Fixed Reference Channel two antenna ports
--------------------------------------------------------------

Parameter	Unit						Val	ue					
Reference		R.10	R.11	R.11-1	R.11-	R.11-	R.11-	R.30	R.30-	R.35-	R.35	R.35-	R.35-3
channel		FDD	FDD	FDD	2	3	4	FDD	1	1	FDD	2	FDD
					FDD	FDD Note 5	FDD		FDD	FDD		FDD	
Channel bandwidth	MHz	10	10	10	5	10	10	20	15	20	10	15	10
Allocated		50	50	50	25	40	50	100	75	100	50	75	50
resource blocks (Note 4)													
Allocated subframes per Radio Frame		9	9	9	9	9	9	9	8	8	9	8	8
Modulation		QPSK	16QAM	16QAM	16QA M	16QA M	QPS K	16QA M	16QA M	64QA M	64QAM	64QA M	64QA M
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39	1/2	0.39	0.39
Information Bit Payload (Note 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	4392	12960	12960	5736	1029 6	6968	2545 6	1908 0	3057 6	19848	2292 0	15264
For Sub- Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub- Frame 0	Bits	4392	12960	N/A	4968	1029 6	6968	2545 6	N/A	N/A	18336	N/A	N/A
Number of Code Blocks (Notes 3 and 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	1	3	3	1	2	2	5	4	5	4	4	3
For Sub- Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub- Frame 0	Bits	1	3	N/A	1	2	2	5	N/A	N/A	3	N/A	N/A
Binary Channel Bits (Note 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	26400	1200 0	2112 0	1320 0	5280 0	3960 0	7920 0	39600	5940 0	39600
For Sub- Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub- Frame 0	Bits	12384	24768	N/A	1036 8	1948 8	1238 4	5116 8	N/A	N/A	37152	N/A	N/A
Max. Throughput averaged over 1 frame (Note	Mbps	3.953	11.664	10.368	5.086	9.266	6.271	22.91 0	15.26 4	24.46 1	17.712	18.33 6	12.211
4)													
UE Category		≥1	≥ 2	≥2	≥ 1	≥ 1	<u>≥1</u>	≥ 2	≥ 2	4	≥ 2	≥ 2	≥ 2
MHz; 4 Note 2: Refere	1 symbols ence sign	s allocate al, synchi	d to PDCC onization	H for 1.4 M signals and	ИНz. I PBCH a	allocated	as per TS	6 36.211	[4].		to PDCCH		
L = 0 E	Bit).		rrier per co			010000		L - 27 D					101 1100
				DD45 are	- 11 4 -	-1							

Note 5: For R.11-3 resource blocks of RB6–RB45 are allocated.

Parameter	Unit				Val	ue			
Reference channel		R.46	R.47	R.35-4					
		FDD	FDD	FDD					
Channel bandwidth	MHz	10	10	10					
Allocated resource blocks (Note 4)		50	50	50					
Allocated subframes per Radio Frame		9	9	9					
Modulation		QPSK	16QAM	64QAM					
Target Coding Rate				0.47					
Information Bit Payload (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	5160	8760	18336					
For Sub-Frame 5	Bits	N/A	N/A	N/A					
For Sub-Frame 0	Bits	5160	8760	16416					
Number of Code Blocks									
(Notes 3 and 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	2	3					
For Sub-Frame 5	Bits	N/A	N/A	N/A					
For Sub-Frame 0	Bits	1	2	3					
Binary Channel Bits (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	39600					
For Sub-Frame 5	Bits	N/A	N/A	N/A					
For Sub-Frame 0	Bits	12384	24768	37152					
Max. Throughput averaged over 1	Mbps	4.644	7.884	16.310					
frame (Note 4)									
UE Category		≥1	≥ 1	≥2					
Note 1: 2 symbols allocated to PDCCI				IHz channe	el BW; 3 s	ymbols	allocated	to PDCCH	for 5 MHz
and 3 MHz; 4 symbols allocate Note 2: Reference signal, synchroniza				d as per TS	6 36.211 [	4]			
Note 3: If more than one Code Block i (otherwise L = 0 Bit)							ached to e	each Code	Block
Note 4: Given per component carrier p	per codewo	ord.							

Table A.3.3.2.1-2: Fixed Reference Channel two antenna ports

Parameter	Unit	Value						
Reference channel		R.60 FDD						
Channel bandwidth	MHz	10						
Number of CRS ports		2						
Allocated resource blocks		50						
Allocated subframes per Radio Frame		8						
Modulation		64QAM						
Coding Rate								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.54						
For Sub-Frame 5		n/a						
For Sub-Frame 0		n/a						
Information Bit Payload								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	21384						
For Sub-Frame 5	Bits	n/a						
For Sub-Frame 0	Bits	n/a						
Number of Code Blocks per Sub-Frame (Note 3)								
For Sub-Frames 1,2,3,4,6,7,8,9	Code Blocks	4						
For Sub-Frame 5	Code Blocks	n/a						
For Sub-Frame 0	Code Blocks	n/a						
Binary Channel Bits Per Sub-Frame (Note 4)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	39600						
For Sub-Frame 5	Bits	n/a						
For Sub-Frame 0	Bits	n/a						
Max. Throughput averaged over 1 frame (Note 4)	Mbps	17.11						
UE Category		≥ 3						
Note 1:       2 symbols allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       If more than one Code Block is present, an additional CRC sequence of								
L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 4: Given per component carrier per codeword.								

# Table A.3.3.2.1-3: PCell and SCell Fixed Reference Channel for NC CA demodulation with timing offset and power imbalance

### A.3.3.2.2 Four antenna ports

Parameter	Unit				Value			
Reference channel		R.12	R.13	R.14	R.14-1	R.14-2	R.14-3	R.36
		FDD	FDD	FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10
Allocated resource blocks (Note 4)		6	50	50	6	3	100	50
Allocated subframes per Radio Frame		9	9	9	8	8	9	9
Modulation		QPSK	QPSK	16QAM	16QAM	16QAM	16QAM	64QAM
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2
Information Bit Payload (Note 4)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	4392	12960	1544	744	[25456]	18336
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A
For Sub-Frame 0	Bits	152	3624	11448	N/A	N/A	[22920]	18336
Number of Code Blocks								
(Notes 3 and 4)								
For Sub-Frames 1,2,3,4,6,7,8,9		1	1	3	1	1	5	3
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	n/a	N/A
For Sub-Frame 0		1	1	2	N/A	N/A	4	3
Binary Channel Bits (Note 4)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1248	12800	25600	3072	1536	51200	38400
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A
For Sub-Frame 0	Bits	480	12032	24064	N/A	N/A	49664	36096
Max. Throughput averaged over 1	Mbps	0.342	3.876	11.513	1.235	0.595	[22.656]	16.502
frame (Note 4)								
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥2	≥ 2
Note 1: 2 symbols allocated to PDCC 5 MHz and 3 MHz; 4 symbols					el BW; 3 sy	mbols allo	cated to PD	OCCH for
Note 2: Reference signal, synchroniz					S 36.211 [4	4].		
Note 3: If more than one Code Block							d to each C	ode
Block (otherwise L = 0 Bit).		•		•				
Note 4: Given per component carrier per codeword.								

#### Table A.3.3.2.2-1: Fixed Reference Channel four antenna ports

Note 4: Given per component carrier per codeword.

## A.3.3.3 Reference Measurement Channel for UE-Specific Reference Symbols

### A.3.3.3.1 Two antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

	Parameter	Unit	Value				
Deference	e channel	Unit	R.51 FDD				
		NAL I-					
	bandwidth	MHz	10				
	I resource blocks		50 (Note 3)				
	l subframes per Radio Frame		9				
Modulatio			16QAM				
	oding Rate		1/2				
	on Bit Payload						
	-Frames 1,4,6,9	Bits	11448				
	-Frames 2,3,7,8	Bits	11448				
	-Frame 5	Bits	N/A				
	-Frame 0	Bits	9528				
Number	of Code Blocks (Note 4)						
For Sub	-Frames 1,4,6,9	Code	2				
		blocks					
For Sub	-Frames 2,3,7,8	Code	2				
		blocks					
For Sub	-Frame 5	Bits	N/A				
For Sub	-Frame 0	Bits	2				
Binary Cl	hannel Bits						
For Sub	-Frames 1,4,6,9	Bits	24000				
For Sub	-Frames 2,7		23600				
For Sub	-Frames 3,8		23200				
For Sub	-Frame 5	Bits	N/A				
For Sub	-Frame 0	Bits	19680				
Max. Thr	oughput averaged over 1	Mbps	10.1112				
frame		-					
UE Categ	gory		≥2				
Note 1:	2 symbols allocated to PDCCI	۲.					
Note 2:	Reference signal, synchroniza	tion signal	s and PBCH				
	allocated as per TS 36.211 [4]						
Note 3:	50 resource blocks are allocat						
	4, 6, 7, 8, 9 and 41 resource b						
RB30–RB49) are allocated in sub-frame 0.							
Note 4:	If more than one Code Block is						
	CRC sequence of $L = 24$ Bits	is attached	to each Code				
	Block (otherwise L = 0 Bit).						

# Table A.3.3.3.1-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

The reference measurement channels in Table A.3.3.3.1-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Parameter	Unit		Value	
Reference channel		R.52 FDD	R.53 FDD	R.54 FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)
Allocated subframes per Radio Frame		9	9	9
Modulation		64QAM	64QAM	16QAM
Target Coding Rate		1/2	1/2	1/2
Information Bit Payload				
For Sub-Frames 1,3,4,6,8,9	Bits	18336	18336	11448
For Sub-Frames 2,7	Bits	16416	16416	11448
For Sub-Frame 5	Bits	n/a	n/a	n/a
For Sub-Frame 0	Bits	14688	14688	9528
Number of Code Blocks (Note 4)				
For Sub-Frames 1,3,4,6,8,9	Code	3	3	2
	blocks			
For Sub-Frames 2, 7	Code	3	3	2
	blocks			
For Sub-Frame 5	Bits	n/a	n/a	n/a
For Sub-Frame 0	Bits	3	3	2
Binary Channel Bits				
For Sub-Frames 1,3,4,6,8,9	Bits	36000	36000	24000
For Sub-Frames 2,7		34200	33600	22800
For Sub-Frame 5	Bits	n/a	n/a	n/a
For Sub-Frame 0	Bits	29520	29520	19680
Max. Throughput averaged over 1	Mbps	15.7536	15.7536	10.1112
frame				
Note 1: 2 symbols allocated to PDCCI				
Note 2: Reference signal, synchroniza				
Note 3: 50 resource blocks are allocat			7, 8, 9 and 41 resource	ce blocks (RB0–
RB20 and RB30–RB49) are a				
Note 4: If more than one Code Block i		an additional CRC	sequence of L = 24 Bi	ts is attached to
each Code Block (otherwise L	. = 0 Bit).			

# Table A.3.3.3.1-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

### A.3.3.3.2 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Parameter	Unit		Value					
Reference channel		R.43 FDD	R.50 FDD	R.48 FDD				
Channel bandwidth	MHz	10	10	10				
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note				
				3)				
Allocated subframes per Radio Frame		9	9	9				
Modulation		QPSK	64QAM	QPSK				
Target Coding Rate		1/3	1/2					
Information Bit Payload								
For Sub-Frames 1,4,6,9	Bits	3624	18336	6200				
For Sub-Frames 2,3,7,8	Bits	3624	16416	6200				
For Sub-Frame 5	Bits	N/A	N/A	N/A				
For Sub-Frame 0	Bits	2984	14688	4968				
Number of Code Blocks (Note 4)								
For Sub-Frames 1,4,6,9	Code	1	3	2				
	blocks							
For Sub-Frames 2,3,7,8	Code	1	3	2				
	blocks							
For Sub-Frame 5	Bits	N/A	N/A	N/A				
For Sub-Frame 0	Bits	1	3	1				
Binary Channel Bits								
For Sub-Frames 1,4,6,9	Bits	12000	36000	12000				
For Sub-Frames 2,7		11600	34800	11600				
For Sub-Frames 3,8		11600	34800	12000				
For Sub-Frame 5	Bits	N/A	N/A	N/A				
For Sub-Frame 0	Bits	9840	29520	9840				
Max. Throughput averaged over 1	Mbps	3.1976	15.3696	5.4568				
frame								
UE Category		≥ 1	≥2	≥1				
Note 1: 2 symbols allocated to PDCC								
Note 2: Reference signal, synchroniz	ation signa	ls and PBCH a	llocated as pe	r TS 36.211				
[4].								
Note 3: 50 resource blocks are alloca								
41 resource blocks (RB0–RB								
Bits is attached to each Code	BIOCK (oth	erwise $L = 0 B$	it).					

# Table A.3.3.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

The reference measurement channels in Table A.3.3.3.2-2 apply for verifying FDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

	Parameter	Unit		Value	
Reference	ce channel		R.44	R.45	R.45-1
			FDD	FDD	FDD
Channel	bandwidth	MHz	10	10	10
Allocated	d resource blocks		50 <sup>3</sup>	$50^{3}$	39
Allocated	d subframes per Radio Frame		10	10	10
Modulati	•		QPSK	16QAM	16QAM
Target C	oding Rate		1/3	1/2	1/2
	ion Bit Payload				
	o-Frames (Non CSI-RS subframe)	Bits	3624	11448	8760
	o-Frames (CSI-RS subframe)	Bits	3624	11448	8760
	-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A
subframe	e)				
For Sub	p-Frame 5	Bits	N/A	N/A	N/A
For Sub	p-Frame 0	Bits	2984	9528	8760
Number	of Code Blocks per Sub-Frame				
(Note 4)	·				
For Sub	o-Frames (Non CSI-RS subframe)		1	2	2
For Sub	p-Frames (CSI-RS subframe)		1	2	2
For Sub	o-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A
subframe	e)				
For Sub	p-Frame 5		N/A	N/A	N/A
For Sub	p-Frame 0		1	2	2
Binary C	hannel Bits Per Sub-Frame				
For Sub	o-Frames (Non CSI-RS subframe)	Bits	12000	24000	18720
	o-Frames (CSI-RS subframe)	Bits	11600	23200	18096
For Sub	o-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A
subframe	e)				
For Sub	p-Frame 5	Bits	N/A	N/A	N/A
For Sub	o-Frame 0	Bits	9840	19680	18720
Max. Thr	oughput averaged over 1 frame	Mbps	3.1976	10.1112	7.884
UE Cate	gory		≥ 1	≥2	≥ 1
Note 1:	2 symbols allocated to PDCCH for	r 20 MHz, 15 MI	Hz and 10 MHz	channel BW	/; 3
	symbols allocated to PDCCH for 5	5 MHz and 3 MH	Iz; 4 symbols a	llocated to P	DCCH
	for 1.4 MHz		•		
Note 2:	Reference signal, synchronization				
Note 3:	For R.44 and R.45, 50 resource b				
	41 resource blocks (RB0–RB20 a				
	R.45-1, 39 resource blocks are all	ocated in all sub	bframes (RB0–	RB20 and RI	330–
	RB47).				
Note 4:	If more than one Code Block is pro	esent an additio	onal CRC sequ	ence of $I = 2$	24 Rits is

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

# A.3.4 Reference measurement channels for PDSCH performance requirements (TDD)

# A.3.4.1 Single-antenna transmission (Common Reference Symbols)

	Parameter Unit Value									
Reference	e channel		R.4	R.42		R.2				
			TDD	TDD		TDD				
Channel I	bandwidth	MHz	1.4	20		10				
Allocated	resource blocks (Note 6)		6	100		50				
Uplink-Do	ownlink Configuration (Note 4)		1	1		1				
Allocated	subframes per Radio Frame (D+S)		3	3+2		3+2				
Modulatio	n		QPSK	QPSK		QPSK				
Target Co	oding Rate		1/3	1/3		1/3				
Informatio	on Bit Payload (Note 6)									
For Sub	-Frames 4,9	Bits	408	8760		4392				
For Sub	-Frames 1,6	Bits	N/A	7736		3240				
For Sub	-Frame 5	Bits	N/A	N/A		N/A				
For Sub	-Frame 0	Bits	208	8760		4392				
Number of	of Code Blocks									
(Notes 5 a	and 6)									
For Sub	-Frames 4,9		1	2		1				
For Sub	-Frames 1,6		N/A	2		1				
For Sub-	-Frame 5		N/A	N/A		N/A				
For Sub	-Frame 0		1	2		1				
Binary Ch	nannel Bits (Note 6)									
	-Frames 4,9	Bits	1368	27600		13800				
For Sub	-Frames 1,6	Bits	N/A	22656		11256				
	-Frame 5	Bits	N/A	N/A		N/A				
	-Frame 0	Bits	672	26904		13104				
Max. Thro	oughput averaged over 1 frame	Mbps	0.102	4.175		1.966				
(Note 6)										
UE Categ	jory		≥ 1	≥ 1		≥ 1				
Note 1:	2 symbols allocated to PDCCH for 2	0 MHz, 15 I	MHz and	10 MHz cha	annel E	3W; 3				
	symbols allocated to PDCCH for 5 M									
	PDCCH for 1.4 MHz. For subframe	1&6, only 2	OFDM sy	mbols are a	allocate	ed to				
	PDCCH.									
Note 2:	For BW=1.4 MHz, the information bi									
	zero (no scheduling) to avoid problems with insufficient PDCCH performance at									
	the test point.									
Note 3:										
Note 4:										
Note 4:	As per Table 4.2-2 in TS 36.211 [4].		itional CD	Cooquere	o of I	- 24				
Note 5.	Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).									
Note 6:	Given per component carrier per co		L = 0 Bit).							

### Table A.3.4.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit			Va	lue					
Reference channel				R.3-1	R.3					
				TDD	TDD					
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks				25	50					
Uplink-Downlink Configuration (Note 3)				1	1					
Allocated subframes per Radio Frame (D+S)				3+2	3+2					
Modulation				16QAM	16QAM					
Target Coding Rate				1/2	1/2					
Information Bit Payload										
For Sub-Frames 4,9	Bits			6456	14112					
For Sub-Frames 1,6	Bits			5160	11448					
For Sub-Frame 5	Bits			N/A	N/A					
For Sub-Frame 0	Bits			5736	12960					
Number of Code Blocks per Sub-Frame										
(Note 4)										
For Sub-Frames 4,9				2	3					
For Sub-Frames 1,6				1	2					
For Sub-Frame 5				N/A	N/A					
For Sub-Frame 0				1	3					
Binary Channel Bits Per Sub-Frame										
For Sub-Frames 4,9	Bits			12600	27600					
For Sub-Frames 1,6	Bits			11112	22512					
For Sub-Frame 5	Bits			N/A	N/A					
For Sub-Frame 0	Bits			11208	26208					
Max. Throughput averaged over 1 frame	Mbps			2.897	6.408					
UE Category				≥ 1	≥ 2					
Note 1: 2 symbols allocated to PDCCH for 2	20 MHz, 1	5 MHz an	d 10 MHz	channel BV	; 3 symbol	s allocated	d to			
PDCCH for 5 MHz and 3 MHz; 4 sy	mbols allo	ocated to F	PDCCH for	r 1.4 MHz. F	or subfram	ne 1&6, on	ly 2			
OFDM symbols are allocated to PDCCH.										
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]										
Note 3: As per Table 4.2-2 in TS 36.211 [4].										
Note 4: If more than one Code Block is pres	sent, an a	dditional C	RC seque	ence of $L = 2$	24 Bits is at	tached to	each			
Code Block (otherwise L = 0 Bit).										

### Table A.3.4.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter	Unit	Value							
Reference channel			R.5	R.6 TDD	R.7	R.8	R.9		
			TDD		TDD	TDD	TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks			15	25	50	75	100		
Uplink-Downlink Configuration (Note 3)			1	1	1	1	1		
Allocated subframes per Radio Frame (D+S)			3+2	3+2	3+2	3+2	3+2		
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate			3/4	3/4	3/4	3/4	3/4		
Information Bit Payload									
For Sub-Frames 4,9	Bits		8504	14112	30576	46888	61664		
For Sub-Frames 1,6	Bits		6968	11448	23688	35160	46888		
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits		6968	12576	30576	45352	61664		
Number of Code Blocks per Sub-Frame									
(Note 4)									
For Sub-Frames 4,9			2	3	5	8	11		
For Sub-Frames 1,6			2	2	4	6	8		
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0			2	3	5	8	11		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 4,9	Bits		11340	18900	41400	62100	82800		
For Sub-Frames 1,6	Bits		9828	16668	33768	50868	67968		
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits		9252	16812	39312	60012	80712		
Max. Throughput averaged over 1 frame	Mbps		3.791	6.370	13.910	20.945	27.877		
UE Category			≥ 1	≥2	≥2	≥ 2	≥ 3		
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.									
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3: As per Table 4.2-2 TS 36.211 [4].									
Note 4: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each Code Block (otherwise $L = 0$ Bit)									

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

Block (otherwise L = 0 Bit).

Parameter		Value							
Reference channel			R.6-1	R.7-1	R.8-1	R.9-1	R.9-2		
			TDD	TDD	TDD	TDD	TDD		
Channel bandwidth	MHz		5	10	15	20	20		
Allocated resource blocks (Note 3)			18	17	17	17	83		
Uplink-Downlink Configuration (Note 4)			1	1	1	1	1		
Allocated subframes per Radio Frame (D+S)			3+2	3+2	3+2	3+2	3+2		
Modulation			64QAM	64QAM	64QAM	64QAM	64QAM		
Target Coding Rate			3/4	3/4	3/4	3/4	3/4		
Information Bit Payload									
For Sub-Frames 4,9	Bits		10296	10296	10296	10296	51024		
For Sub-Frames 1,6	Bits		8248	7480	7480	7480	39232		
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits		8248	10296	10296	10296	51024		
Number of Code Blocks per Sub-Frame									
(Note 5)									
For Sub-Frames 4,9			2	2	2	2	9		
For Sub-Frames 1,6			2	2	2	2	7		
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0			2	2	2	2	9		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 4,9	Bits		13608	14076	14076	14076	68724		
For Sub-Frames 1,6	Bits		11880	11628	11628	11628	56340		
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits		11520	14076	14076	14076	66636		
Max. Throughput averaged over 1 frame	Mbps		4.534	4.585	4.585	4.585	23.154		
UE Category	•		≥1	≥ 1	≥1	≥ 1	≥ 2		
Note 1: 2 symbols allocated to PDCCH for 2	20 MHz, 15 I	MHz and	10 MHz ch	annel BW; 3	symbols a	allocated to	PDCCH		
for 5 MHz and 3 MHz; 4 symbols all									
are allocated to PDCCH.					-		-		
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]									

#### Table A.3.4.1-3a: Fixed Reference Channel 64QAM R=3/4

Note 3: Note 4:

Localized allocation started from RB #0 is applied. As per Table 4.2-2 TS 36.211 [4]. If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 5:

Parameter	Unit		lue				
Reference channel			R.0		R.1 TDD		
			TDD				
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Uplink-Downlink Configuration (Note 3)			1		1		
Allocated subframes per Radio Frame (D+S)			3+2		3+2		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits		224		256		
For Sub-Frames 1,6	Bits		208		208		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9			1		1		
For Sub-Frames 1,6			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits		504		552		
For Sub-Frames 1,6	Bits		456		456		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		504		552		
Max. Throughput averaged over 1 frame	Mbps		0.109		0.118		
UE Category			≥ 1		≥ 1		
Note 1:       2 symbols allocated to PDCCH for 2         PDCCH for 5 MHz and 3 MHz; 4 symbols are allocated to PD         OFDM symbols are allocated to PD         Note 2:       Reference signal, synchronization s         Note 3:       As per Table 4.2-2 in TS 36.211 [4].	mbols alloc CCH. ignals and	ated to Pl	DCCH for 1.4	MHz. F	or subframe 1		
Note 4: If more than one Code Block is pres		ditional CE		of I = 2	4 Rits is attac	had to a	ach

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

	Parameter	Unit	Value
Reference ch	annel		R.29 TDD
			(MBSFN)
Channel ban	dwidth	MHz	10
Allocated res	ource blocks		1
MBSFN Cont	iguration (Note 3)		010010
Uplink-Down	ink Configuration (Note 4)		1
Allocated sub	frames per Radio Frame (D+S)		1+2
Modulation			16QAM
Target Codin	g Rate		1/2
Information E	it Payload		
For Sub-Fra	imes 4,9	Bits	0 (MBSFN)
For Sub-Fra	imes 1,6	Bits	208
For Sub-Fra	ime 5	Bits	N/A
For Sub-Fra		Bits	256
Number of C	ode Blocks per Sub-Frame		
(Note 5)			
For Sub-Fra		Bits	0 (MBSFN)
For Sub-Fra	imes 1,6	Bits	1
For Sub-Fra	ime 5	Bits	N/A
For Sub-Fra		Bits	1
Binary Chanr	nel Bits Per Sub-Frame		
For Sub-Fra	imes 4,9	Bits	0 (MBSFN)
For Sub-Fra		Bits	456
For Sub-Fra	ime 5	Bits	N/A
For Sub-Fra		Bits	552
Max. Throug	nput averaged over 1 frame	kbps	67.2
UE Category			≥1
	symbols allocated to PDCCH.		
	eference signal, synchronization s r TS 36.211 [4].	ignals and	PBCH allocated as
	BSFN Subframe Allocation as def	ined in [7]	one frame with 6
	s is chosen for MBSFN subframe		
	per Table 4.2-2 in TS 36.211 [4].		
	more than one Code Block is pres		litional CRC
	quence of $L = 24$ Bits is attached		
	= 0 Bit).		
	/		

### Table A.3.4.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Parameter Unit Value									
Reference channel					R.41					
					TDD					
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks					50					
Uplink-Downlink Configuration (Note 4)					1					
Allocated subframes per Radio Frame (D+S)					3+2					
Modulation					QPSK					
Target Coding Rate					1/10					
Information Bit Payload										
For Sub-Frames 4,9	Bits				1384					
For Sub-Frames 1,6	Bits				1032					
For Sub-Frame 5	Bits				N/A					
For Sub-Frame 0	Bits				1384					
Number of Code Blocks per Sub-Frame										
(Note 5)										
For Sub-Frames 4,9					1					
For Sub-Frames 1,6					1					
For Sub-Frame 5					N/A					
For Sub-Frame 0					1					
Binary Channel Bits Per Sub-Frame										
For Sub-Frames 4,9	Bits				13800					
For Sub-Frames 1,6	Bits				11256					
For Sub-Frame 5	Bits				N/A					
For Sub-Frame 0	Bits				13104					
Max. Throughput averaged over 1 frame	Mbps				0.622					
UE Category					≥1					
Note 1: 2 symbols allocated to PDCCH for 2										
to PDCCH for 5 MHz and 3 MHz; 4			PDCCH	for 1.4 M	Hz. For su	ıbframe	1&6,			
only 2 OFDM symbols are allocated										
Note 2: For BW=1.4 MHz, the information b					t to zero (	no scheo	duling)			
	to avoid problems with insufficient PDCCH performance at the test point.									
Note 4: As per Table 4.2-2 in TS 36.211 [4]			-			_				
Note 5: If more than one Code Block is pres		tional CR	C seque	nce of L	= 24 Bits i	s attache	ed to			
each Code Block (otherwise L = 0 E	Bit).									

Table A.3.4.1-6: Fixed Reference Channel QPSK R=1/10

Parameter Unit Value								
Reference channel		R.49 TDD						
Channel bandwidth	MHz	20						
Allocated resource blocks		100						
Uplink-Downlink Configuration (Note 1)		1						
Allocated subframes per Radio Frame		3+2						
(D+S)								
Modulation		64QAM						
Number of OFDM symbols for PDCCH								
per component carrier								
For Sub-Frames 0,4,5,9	OFDM	3						
	symbols							
For Sub-Frames 1,6	<b>OFDM</b>	2						
	symbols							
Target Coding Rate								
For Sub-Frames 4,9		0.84						
For Sub-Frames 1,6		0.81						
For Sub-Frames 5		N/A						
For Sub-Frames 0		0.87						
Information Bit Payload								
For Sub-Frames 0, 4, 9	Bits	63776						
For Sub-Frame 1,6	Bits	55056						
For Sub-Frame 5	Bits	N/A						
Number of Code Blocks per Sub-Frame								
(Note 2)								
For Sub-Frames 0, 4, 9	Code	11						
	Blocks							
For Sub-Frame 1,6	Code	9						
	Blocks							
For Sub-Frame 5	Code	N/A						
	Blocks							
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 4,9	Bits	75600						
For Sub-Frame 1,6	Bits	67968						
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	73512						
Max. Throughput averaged over 1 frame	Mbps	30.144						
UE Category ≥5								
Note 1: Reference signal, synchronizatio	n signals an	d PBC						
allocated as per TS 36.211 [4].	allocated as per TS 36.211 [4].							
Note 2: If more than one Code Block is p								
CRC sequence of L = 24 Bits is attached to each Code								
Block (otherwise L = 0 Bit).								

### Table A.3.4.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

## A.3.4.2 Multi-antenna transmission (Common Reference Signals)

### A.3.4.2.1 Two antenna ports

Parameter	Unit							Value					
Reference channel		R.10 TDD	R.11 TDD	R.11-1 TDD	R.11-2 TDD	R.11-3 TDD Note 6	R.11-4 TDD	R.30 TDD	R.30-1 TDD	R.30-2 TDD			
Channel bandwidth	MHz	10	10	10	5	10	10	20	20	20			
Allocated resource blocks (Note 5)		50	50	50	25	40	50	100	100	100			
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1	1	1	1			
Allocated subframes per Radio Frame (D+S)		3+2	3+2	2+2	3+2	3+2	2	3+2	2+2	2			
Modulation		QPSK	16QAM	16QAM	16QAM	16QAM	QPSK	16QAM	16QAM	16QAM			
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2			
Information Bit Payload (Note 5)													
For Sub-Frames 4,9	Bits	4392	12960	12960	5736	10296	6968	25456	25456	25456			
For Sub-Frames 1,6		3240	9528	9528	5160	9144	N/A	22920	21384	N/A			
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	4392	12960	N/A	4968	10296	N/A	25456	N/A	N/A			
Number of Code Blocks (Notes 4 and 5)													
For Sub-Frames 4,9		1	3	3	1	2	2	5	5	5			
For Sub-Frames 1,6		1	2	2	1	2	N/A	4	4	N/A			
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0		1	3	N/A	1	2	N/A	5	N/A	N/A			
Binary Channel Bits (Note 5)													
For Sub-Frames 4,9	Bits	13200	26400	26400	12000	21120	13200	52800	52800	52800			
For Sub-Frames 1,6		10656	21312	21312	10512	16992	10656	42912	42912	N/A			
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
For Sub-Frame 0	Bits	12528	25056	N/A	10656	19776	12528	51456	N/A	N/A			
Max. Throughput averaged over 1 frame (Note 5)	Mbps	1.966	5.794	4.498	2.676	4.918	1.39	12.221	9.368	5.091			
UE Category		≥1	≥2	≥2	≥1	≥1	≥1	≥2	≥2	3			

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz; symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (other

Note 5: Given per component carrier per codeword.

Note 6: For R.11-3 resource blocks of RB6–RB45 are allocated.

Reference channelR.46 TDDR.47 TDDR.35-2 TDDChannel bandwidthMHz101010Allocated resource505050blocks (Note 5)111Qplink-Downlink111Configuration (Note 3)3+23+22+2Allocated subframes per Radio Frame3+23+22+2ModulationQPSK16QAM64QAMTarget Coding Rate Information Bit Payload (Note 5)0.471Payload (Note 5)5160876018336For Sub-Frames 1,63880748014688For Sub-Frames 1,63880748014688For Sub-Frames 1,6123For Sub-Frames 4,9123For Sub-Frames 5N/AN/AN/ANumber of Code Blocks123For Sub-Frames 4,9123For Sub-Frames 4,912N/ANote 5)	Parameter	Unit	Unit Value						
Channel bandwidthMHz101010Channel bandwidthMHz10101010Allocated resource50505050blocks (Note 5)11111Configuration (Note11111a)Configuration (Note3)3+23+22+2per Radio Frame047111(D+S)000111ModulationQPSK16QAM64QAM11Target Coding Rate0.471111Information BitPayload (Note 5)1211For Sub-Frames 1,61838074801468811For Sub-Frame 1,6Bits51608760N/A11For Sub-Frame 0Bits51608760N/A111Number of CodeBits51608760N/A111111For Sub-Frame 1,612311111111111111111111111111111111111111111111111111111111 <td></td> <td></td> <td>R.46 TDD</td> <td>R.47 TDD</td> <td></td> <td></td> <td></td> <td></td>			R.46 TDD	R.47 TDD					
Allocated resource       50       50       50       50         blocks (Note 5)       1       1       1       1         Configuration (Note 3)       3+2       3+2       2+2         Allocated subframes per Radio Frame (D+S)       3+2       3+2       2+2         Modulation       QPSK       16QAM       64QAM         Target Coding Rate (D+S)       0.47       1         Payload (Note 5)       -       -         For Sub-Frames 1,6       3880       7480         For Sub-Frames 1,6       3880       7480         For Sub-Frames 1,6       3880       7480         Number of Code Blocks       -       -         Blocks       -       -         (Note 5)       -       -         For Sub-Frames 1,6       1       2         For Sub-Frames 4,9       1       2       3         For Sub-Frames 4,9       1       2       3         For Sub-Frames 1,6       1       2       3         For Sub-Frame 5       N/A       N/A       N/A         For Sub-Frame 5,1       1       2       3         For Sub-Frame 5       N/A       N/A       -         F									
Allocated resource       50       50       50       50         blocks (Note 5)       1       1       1       1         Configuration (Note 3)       3+2       3+2       2+2         Allocated subframes per Radio Frame (D+S)       3+2       2+2         Modulation       QPSK       16QAM       64QAM         Target Coding Rate (D+S)       0.47       Information Bit       94         Payload (Note 5)	Channel bandwidth	MHz	10	10	10				
Uplink-Downlink Configuration (Note 3)1111Allocated subframes per Radio Frame (D+S) $3+2$ $3+2$ $2+2$ ModulationQPSK16QAM64QAMTarget Coding Rate Information Bit Payload (Note 5)0.470.47For Sub-Frames 1,63880748014688For Sub-Frames 1,63880748014688For Sub-Frames 1,63880748014688For Sub-Frames 5BitsN/AN/ANumber of Code Blocks912Number of Code Blocks912For Sub-Frames 5,6123For Sub-Frames 5,6N/AN/AN/AFor Sub-Frames 1,6123For Sub-Frames 5,6N/AN/AN/AFor Sub-Frames 5,6N/AN/AN/AFor Sub-Frames 6,7123For Sub-Frames 1,6123For Sub-Frame 6,612N/AFor Sub-Frame 7,612N/AFor Sub-Frame 8,9123For Sub-Frame 9,16106562131231968For Sub-Frame 9,171152825056N/AFor Sub-Frame 0Bits1252825056NdaN/AN/AN/AFor Sub-Frame 0Bits1252825056Note 1:2×1<<	Allocated resource		50						
Uplink-Downlink Configuration (Note 3)1111Allocated subframes per Radio Frame (D+S) $3+2$ $3+2$ $2+2$ ModulationOPSK16QAM64QAMTarget Coding Rate Information Bit Payload (Note 5)0.470.47For Sub-Frames 1,63880748014688For Sub-Frames 1,63880748014688For Sub-Frames 1,63880748014688For Sub-Frames 5BitsN/AN/ANumber of Code Blocks912Number of Code Blocks912For Sub-Frames 5,6123For Sub-Frames 5,6N/AN/AN/AFor Sub-Frames 6,6123For Sub-Frames 1,6123For Sub-Frames 5,6N/AN/AN/AFor Sub-Frames 6,7123For Sub-Frames 1,6123For Sub-Frame 6,612N/AFor Sub-Frame 7,612N/AFor Sub-Frame 8,9123For Sub-Frame 9,16106562131231968For Sub-Frame 9,171152825056N/AFor Sub-Frame 012N/AFor Sub-Frame 0121For Sub-Frame 0Bits1252825056Note 1:222Vertare 0Bits1252825056Note 1:222	blocks (Note 5)								
Configuration (Note 3)3+23+22+2Allocated subframes per Radio Frame (D+S)3+23+22+2per Radio Frame (D+S)0.470.47Target Coding Rate0.470.47Information Bit Payload (Note 5)0.470.47For Sub-Frames 4.9Bits51608760For Sub-Frames 1.63880748014688For Sub-Frame 5Bits51608760N/AFor Sub-Frame 0Bits51608760N/AFor Sub-Frame 0Bits51608760N/ANumber of Code Blocks0.470.470.4688(Notes 4 and 5)0.470.470.47For Sub-Frames 1.6123For Sub-Frame 0120.47For Sub-Frame 0120.47Binary Channel Bits0.410.47For Sub-Frame 0120.460For Sub-Frame 0121.424For Sub-Frame 01.252825056N/AMax. Throughput Mbps2.3244.1246.604averaged over 1122Itame (Note 5)122	Uplink-Downlink		1	1	1				
Allocated subframes per Radio Frame (D+S) $3+2$ $3+2$ $2+2$ ModulationQPSK16QAM64QAMTarget Coding Rate0.47Information Bit Payload (Note 5)0.47For Sub-Frames 4.9Bits5160For Sub-Frames 1.63880For Sub-Frames 0BitsStub-Frame 0BitsStub-Frame 0BitsBick 51608760Number of CodeBlocksNumber of Sub-Frames 5Nub-Frame 5For Sub-Frames 1.6Tor Sub-Frames 5Nub-Frame 5Nub-Frame 5Nub-Frame 6For Sub-Frames 5N/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/A	Configuration (Note								
per Radio Frame (D+S)QPSK16QAM64QAMTarget Coding Rate0.471Target Coding Rate0.47Information Bit Payload (Note 5)0.47For Sub-Frames 4,9Bits5160For Sub-Frames 1,638807480Tor Sub-Frame 5BitsN/AN/AN/AN/ANumber of Code Blocks8760Number of Code Blocks0Bits5160For Sub-Frames 1,6123For Sub-Frames 1,6123For Sub-Frames 4,9123For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 5BitsNote 5)1For Sub-Frame 5BitsFor Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 5BitsN/AN/AN/AN/AFor Sub-Frame 5BitsN/AN/AN/AN/AMax. ThroughputMbps2.3244.1244.6604averaged over 1frame (Note 5)UE Category≥1VE 12Note 1:<	3)								
(D+S)QPSK16QAM64QAMTarget Coding Rate0.47Information Bit0.47Payload (Note 5)0.47For Sub-Frames 4,9BitsFor Sub-Frames 1,63880748014688For Sub-Frame 0BitsSite State880For Sub-Frame 0BitsBits51608760N/ANumber of CodeBlocks0(Notes 4 and 5)0For Sub-Frame 0123For Sub-Frame 1,61Por Sub-Frames 1,61For Sub-Frame 5N/AN/AN/AN/AFor Sub-Frame 6Number of CodeBinary Channel Bits(Note 5)For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/A </td <td>Allocated subframes</td> <td></td> <td>3+2</td> <td>3+2</td> <td>2+2</td> <td></td> <td></td> <td></td>	Allocated subframes		3+2	3+2	2+2				
ModulationQPSK16QAM64QAMTarget Coding Rate0.47Information BitPayload (Note 5)For Sub-Frames 4.9BitsFor Sub-Frames 1.63880For Sub-Frame 5BitsN/AN/AN/AN/AFor Sub-Frame 0BitsBits51608760N/AFor Sub-Frame 0Bits51608760Number of CodeBlocksNotes 4 and 5)For Sub-Frames 1.61For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/AN/A<	per Radio Frame								
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Max. Throughput averaged over 1 frame (Note 5)       Mbps       2.324       4.124       6.604         UE category       ≥ 1       ≥ 1       ≥ 2         Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       As per Table 4.2-2 in TS 36.211 [4].         Note 4:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).									
averaged over 1       frame (Note 5)       ≥ 1       ≥ 1       ≥ 2         UE Category       ≥ 1       ≥ 1       ≥ 2          Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       As per Table 4.2-2 in TS 36.211 [4].         Note 4:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).									
frame (Note 5)       ≥ 1       ≥ 1       ≥ 2         UE Category       ≥ 1       ≥ 1       ≥ 2         Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       As per Table 4.2-2 in TS 36.211 [4].         Note 4:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).		Mbps	2.324	4.124	6.604				
UE Category       ≥ 1       ≥ 1       ≥ 2         Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       As per Table 4.2-2 in TS 36.211 [4].         Note 4:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).									
<ul> <li>Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&amp;6, only 2 OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: As per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>									
<ul> <li>to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&amp;6, only 2 OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: As per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>						 			
<ul> <li>only 2 OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: As per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>									
<ul> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: As per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>					ted to PDCC		IHZ. FOR SUDI	rame 1&6,	
<ul> <li>Note 3: As per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>							36 211 [4]		
Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).									
each Code Block (otherwise L = 0 Bit).								ttached to	

Table A.3.4.2.1-2: Fixed Reference Channel two antenna ports

### A.3.4.2.2 Four antenna ports

Parameter	Unit				Value			
Reference channel		R.12	R.13	R.14	R.14-1	R.14-2	R.43	R.36
		TDD	TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10
Allocated resource blocks (Note 6)		6	50	50	6	3	100	50
Uplink-Downlink Configuration (Note 1 1 1 1 1 1 1 1							1	
							2+2	
Frame (D+S)								
Modulation		QPSK	QPSK	16QAM	16QAM	16QAM	16QAM	64QAM
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2
Information Bit Payload (Note 6)								
For Sub-Frames 4,9	Bits	408	4392	12960	1544	744	25456	18336
For Sub-Frames 1,6	Bits	N/A	3240	9528	N/A	N/A	21384	15840
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 Bits 208 4392 N/A						N/A	N/A	N/A
Number of Code Blocks								
(Notes 5 and 6)								
For Sub-Frames 4,9	For Sub-Frames 4,9         1         1         3         1         1         5						3	
For Sub-Frames 1,6		N/A	1	2	N/A	N/A	4	3
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits (Note 6)								
For Sub-Frames 4,9	Bits	1248	12800	25600	3072	1536	51200	38400
For Sub-Frames 1,6		N/A	10256	20512	N/A	N/A	41312	30768
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	624	12176	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1	Mbps	0.102	1.966	4.498	0.309	0.149	9.368	6.835
frame (Note 6)								
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 2	≥2
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.								
Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.								I
Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].								
Note 4: As per Table 4.2-2 in TS 36.211 [4]. Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block								
(otherwise $L = 0$ Bit).			nal CRC seq	uence of L	= 24 Bits is	s attached to	o each Cod	le Block
Noto 6: Given per component carrie								

### Table A.3.4.2.2-1: Fixed Reference Channel four antenna ports

Note 6: Given per component carrier per codeword.

## A.3.4.3 Reference Measurement Channels for UE-Specific Reference Symbols

### A.3.4.3.1 Single antenna port (Cell Specific)

The reference measurement channels in Table A.3.4.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

Reference channel         R.25 TDD         R.26 TDD         R.26 TDD         R.26 TDD         R.26 TDD         R.27 TDD         TDD         TDD         TDD           Allocated resource blocks         50 <sup>4</sup> 50 <sup>4</sup> 25 <sup>4</sup> 50 <sup>4</sup> 10         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 </th <th>Parameter</th> <th>Unit</th> <th></th> <th colspan="6">Value</th>	Parameter	Unit		Value					
Allocated resource blocks         50 <sup>4</sup> 50 <sup>4</sup> 25 <sup>4</sup> 50 <sup>4</sup> 18 <sup>6</sup> Uplink-Downlink Configuration (Note 3)         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <t< td=""><td></td><td></td><td>R.25</td><td></td><td>R.26-1</td><td>R.27</td><td></td><td>R.28 TDD</td></t<>			R.25		R.26-1	R.27		R.28 TDD	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	annel bandwidth	MHz	10	10	5	10	10	10	
Allocated subframes per Radio Frame (D+S) $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$ $3+2$			50 <sup>4</sup>	50 <sup>4</sup>	25 <sup>4</sup>	50 <sup>4</sup>	18 <sup>6</sup>	1	
(D+S)QPSK16QAM64QAM64QAMTarget Coding Rate1/31/21/23/43/4Information Bit Payload1/31/21/23/43/4Information Bit Payload9Bits43921296057362833610296For Sub-Frames 4.9Bits324095284584229208248For Sub-Frame 5Bits324095284584229208248For Sub-Frame 0Bits2984952838802215210296Number of Code Blocks per Sub-Frame13152For Sub-Frames 4.913152For Sub-Frames 1.612142For Sub-Frame 5N/AN/AN/AN/AN/AFor Sub-Frame 612142For Sub-Frame 713152For Sub-Frame 712142For Sub-Frame 912142Biary Channel Bits Per Sub-Frame12142For Sub-Frame 9.612142For Sub-Frame 9.612142For Sub-Frame 912142For Sub-Frame 912142For Sub-Frame 912142For Sub-Frame 91222 <td< td=""><td>link-Downlink Configuratior</td><td>(Note 3)</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></td<>	link-Downlink Configuratior	(Note 3)	1	1	1	1	1	1	
Target Coding Rate1/31/21/23/43/4Information Bit Payload </td <td>•</td> <td>Frame</td> <td>3+2</td> <td>3+2</td> <td>3+2</td> <td>3+2</td> <td>3+2</td> <td>3+2</td>	•	Frame	3+2	3+2	3+2	3+2	3+2	3+2	
Information Bit PayloadInformation Bit PayloadInformation Bit PayloadFor Sub-Frames 4,9Bits43921296057362833610296For Sub-Frames 1,6Bits324095284584229208248For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0Bits2984952838802215210296Number of Code Blocks per Sub-FrameInformation Bits2984952838802215210296Number of Code Blocks per Sub-FrameInformation Bits2984952838802215210296Number of Code Blocks per Sub-FrameInformation Bits12142For Sub-Frames 1,6121421For Sub-Frame 0Information Bits12142Binary Channel Bits Per Sub-FrameInformation Bits1035620712102123106811340For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5BitsN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.4521.24664.738UE Category≥ 1≥ 2≥ 1≥ 2≥ 1≥ 2≥ 1Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MH	odulation		QPSK	16QAM	16QAM	64QAM	64QAM	16QAM	
For Sub-Frames 4,9         Bits         4392         12960         5736         28336         10296           For Sub-Frames 1,6         Bits         3240         9528         4584         22920         8248           For Sub-Frame 5         Bits         N/A         N/A         N/A         N/A         N/A         N/A           For Sub-Frame 0         Bits         2984         9528         3880         22152         10296           Number of Code Blocks per Sub-Frame (Note 5)         I         3         1         5         2           For Sub-Frames 1,6         1         2         1         4         2           For Sub-Frame 5         N/A         N/A         N/A         N/A         N/A         N/A           For Sub-Frame 0         1         2         1         4         2            Binary Channel Bits Per Sub-Frame         I         2         1         4         2           Binary Channel Bits Per Sub-Frame         Bits         10356         20712         10212         31068         11340           For Sub-Frame 5         Bits         10332         20664         7752         30996         13608           Max. Throughput averaged over	rget Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2	
For Sub-Frames 1,6Bits324095284584229208248For Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0Bits2984952838802215210296Number of Code Blocks per Sub-Frame (Note 5)13152For Sub-Frames 4,913152For Sub-Frames 1,612142For Sub-Frame 6N/AN/AN/AN/AN/AFor Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frame 5.Bits1260025200114003780013608For Sub-Frame 5.Bits1035620712102123106811340For Sub-Frame 5.Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated as per TS 36.211 [4].	ormation Bit Payload								
For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0Bits2984952838802215210296Number of Code Blocks per Sub-Frame (Note 5)13152For Sub-Frames 4,913152For Sub-Frames 1,612142For Sub-Frame 5N/AN/AN/AN/AN/AFor Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frame 5.Bits1260025200114003780013608For Sub-Frame 5.Bits1035620712102123106811340For Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note1 $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.2	or Sub-Frames 4,9	Bits	4392	12960	5736	28336	10296	224	
For Sub-Frame 0Bits2984952838802215210296Number of Code Blocks per Sub-Frame (Note 5)13152For Sub-Frames 4,913152For Sub-Frames 1,612142For Sub-Frame 5N/AN/AN/AN/AN/AFor Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frames 1,6Bits1260025200114003780013608For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30	or Sub-Frames 1,6	Bits	3240	9528	4584	22920	8248	176	
Number of Code Blocks per Sub-Frame (Note 5)Image: Sub-Frame Sub-F	or Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
(Note 5)Image: constraint of the second	or Sub-Frame 0	Bits	2984	9528	3880	22152	10296	224	
For Sub-Frames 1,612142For Sub-Frame 5N/AN/AN/AN/AN/AN/AFor Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frames 4,9Bits1260025200114003780013608For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5Bits103222066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0-RB7 and RB16-RB24) are allocated in sub-frame 5.Note 5:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end	ote 5)	Jb-Frame							
For Sub-Frame 5N/AN/AN/AN/AN/AFor Sub-Frame 012142Binary Channel Bits Per Sub-Frame12142For Sub-Frames 4,9Bits1260025200114003780013608For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5BitsN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0-RB7 and RB16-RB24) are allocated in sub-frames 5.Note 5:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end	or Sub-Frames 4,9		1	3	1	5	2	1	
For Sub-Frame 012142Binary Channel Bits Per Sub-Frame </td <td>,</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td>1</td>	,		-					1	
Binary Channel Bits Per Sub-FrameBits1260025200114003780013608For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1.Note 5:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end	or Sub-Frame 5		N/A		N/A	N/A	N/A	N/A	
For Sub-Frames 4,9Bits1260025200114003780013608For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0-RB7 and RB16-RB24) are allocated in sub-frames to resource blocks is present, an additional CRC sequence of L = 24 Bits is attached to end			1	2	1	4	2	1	
For Sub-Frames 1,6Bits1035620712102123106811340For Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ $\geq 2$ $\geq 1$ Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated pDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1, Let allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1, Let al		rame							
For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0Bits103322066477523099613608Max. Throughput averaged over 1 frameMbps1.8255.4502.45212.4664.738UE Category≥ 1≥ 2≥ 1≥ 2≥ 1≥ 2≥ 1Note 1:2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].Note 4:For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 5:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to e								504	
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Max. Throughput averaged over 1 frame       Mbps       1.825       5.450       2.452       12.466       4.738         UE Category       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 2	or Sub-Frame 5	Bits	N/A	N/A		N/A		N/A	
UE Category       ≥ 1       ≥ 2       ≥ 1       ≥ 2       ≥ 1         Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only OFDM symbols are allocated to PDCCH.         Note 2:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 3:       as per Table 4.2-2 in TS 36.211 [4].         Note 4:       For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1.         Note 5:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end	or Sub-Frame 0	Bits	10332	20664		30996	13608	504	
<ul> <li>Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&amp;6, only OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: as per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1.</li> <li>Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end of the second second</li></ul>	ax. Throughput averaged ov	er 1 frame Mbps	1.825	5.450	2.452	12.466	4.738	0.102	
<ul> <li>PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&amp;6, only OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: as per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frames 1.</li> <li>Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to end of the second s</li></ul>	Category		≥ 1	≥ 2	≥1	≥ 2	≥1	≥1	
Code Block (otherwise L = 0 Bit). Note 6: Localized allocation started from RB #0 is applied.	nly 2 ce blocks llocated -frame 0.								

#### Two antenna ports (Cell Specific) A.3.4.3.2

The reference measurement channels in Table A.3.4.3.2-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports.

Reference channel		R.31	R.32	R.32-1	R.33	R.33-1	R.34
		TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	10	10	5	10	10	10
Allocated resource blocks		50 <sup>4</sup>	50 <sup>4</sup>	25 <sup>4</sup>	50 <sup>4</sup>	18 <sup>6</sup>	50 <sup>4</sup>
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2	3+2
Modulation QPSK 16QAM 16QAM 64QAM 64QAM 64Q							
Target Coding Rate         1/3         1/2         1/2         3/4         3/4         1/2							
Information Bit Payload							
For Sub-Frames 4,9	Bits	3624	11448	5736	27376	9528	18336
For Sub-Frames 1,6		2664	7736	3112	16992	7480	11832
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	2984	9528	3496	22152	9528	14688
Number of Code Blocks per Sub-Frame (Note 5)							
For Sub-Frames 4,9		1	2	1	5	2	3
For Sub-Frames 1,6		1	2	1	3	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	1	4	2	3
Binary Channel Bits Per							
Sub-Frame							
For Sub-Frames 4,9	Bits	12000	24000	10800	36000	12960	36000
For Sub-Frames 1,6		7872	15744	6528	23616	10368	23616
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	9840	19680	7344	29520	12960	29520
Max. Throughput	Mbps	1.556	4.79	2.119	11.089	4.354	7.502
averaged over 1 frame							
UE Category		≥ 1	≥2	≥ 1	≥2	≥ 1	≥ 2
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.							
Note 2:Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].Note 3:as per Table 4.2-2 in TS 36.211 [4].							
Note 4: For R.31, R.32, R.33and R.34, 50 resource blocks are allocated in sub-frames 4,9 and 41							
resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the							
DwPTS portion of sub-frames 1,6. For R.32-1, 25 resouce blocks are allocated in sub-							
frames 4,9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame							
0 and the DwPTS portion of sub-frames 1, 6. Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is							
					C sequence	e of L = 24 E	Bits is
attached to each Code Block (otherwise L = 0 Bit). Note 6: Localized allocation started from RB #0 is applied.							

Table A.3.4.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS
----------------------------------------------------------------------

### A.3.4.3.3 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.3-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

	Parameter	Unit	Value
Referenc	e channel		R.51 TDD
Channel	bandwidth	MHz	10
Allocated	resource blocks		50 (Note 5)
Uplink-Do	ownlink Configuration (Note 3)		1
Allocated (D+S)	subframes per Radio Frame		3+2
Modulatio	on		16QAM
	oding Rate		1/2
	on Bit Payload		
	-Frames 4,9 (non CSI-RS	Bits	11448
subframe			
For Sub	-Frame 4,9	Bits	11448
	-Frames 1,6	Bits	7736
	-Frame 5	Bits	N/A
	-Frame 0	Bits	9528
	of Code Blocks		
(Note 4)			
For Sub	-Frames 4, 9 (non CSI-RS	Code	2
subframe	)	blocks	
For Sub	-Frames 4,9	Code	2
		blocks	
For Sub	-Frames 1,6	Code	2
		blocks	
	-Frame 5		N/A
For Sub	-Frame 0	Code	2
		blocks	
	nannel Bits		
	-Frames 4, 9 (non CSI-RS	Bits	24000
subframe			
	-Frames 4,9		22800
	-Frames 1,6		15744
	-Frame 5	Bits	N/A
	-Frame 0	Bits	19680
	oughput averaged over 1	Mbps	4.7896
frame			
UE Categ			≥ 2
	2 symbols allocated to PDCC		
Note 2:	Reference signal, synchroniza		s and PBCH
Note 2:	allocated as per TS 36.211 [4]		
Note 3: Note 4:	as per Table 4.2-2 in TS 36.2 <sup>-7</sup> If more than one Code Block i		an additional
NULE 4.	CRC sequence of $L = 24$ Bits		
	Block (otherwise $L = 0$ Bit).	is allauned	
Note 5:	50 resource blocks are allocat	ted in sub₋f	rames / 0 and
NOLE J.	41 resource blocks (RB0–RB2		
	allocated in sub-frame 0 and t		
	sub-frames 1,6.		20100101

# Table A.3.4.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

The reference measurement channels in Table A.3.4.3.3-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Parameter	Unit		Value					
Reference channel		R.52 TDD	R.53 TDD	R.54 TDD				
Channel bandwidth	MHz	10	10	10				
Allocated resource blocks		50 (Note 5)	50 (Note 5)	50 (Note 5)				
Uplink-Downlink Configuration (Note 3)		1	1	1				
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2				
Modulation		64QAM	64QAM	16QAM				
Target Coding Rate		1/2	1/2	1/2				
Information Bit Payload		172						
For Sub-Frame 4,9	Bits	16416	16416	11448				
For Sub-Frames 1,6	Bits	11832	11832	7736				
For Sub-Frame 5	Bits	n/a	n/a	n/a				
For Sub-Frame 0	Bits	14688	14688	9528				
Number of Code Blocks (Note 4)								
For Sub-Frames 4,9	Code blocks	3	3	2				
For Sub-Frames 1,6	Code blocks	2	2	2				
For Sub-Frame 5		n/a	n/a	n/a				
For Sub-Frame 0	Code blocks	3	3	2				
Binary Channel Bits								
For Sub-Frames 4,9		34200	33600	22800				
For Sub-Frames 1,6		23616	23616	15744				
For Sub-Frame 5	Bits	n/a	n/a	n/a				
For Sub-Frame 0	Bits	29520	29520	19680				
Max. Throughput averaged over 1 frame	Mbps	7.1184	7.1184	4.7896				
UE Category		≥2	≥2	≥2				
Note 1: 2 symbols allocated to PDCCH Note 2: Reference signal, synchroniza			1	1				
Note 3: as per Table 4.2-2 in TS 36.21	11 [4].			<u>-</u> [.].				
Note 4: If more than one Code Block is	If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each Code Block (otherwise $L = 0$ Bit).							
Note 5: 50 resource blocks are allocat and RB30–RB49) are allocate 6.	ed in sub-f	rames 4, 9 and 4						

# Table A.3.4.3.3-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

### A.3.4.3.4 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.4-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Parameter Unit Value								
	Unit							
Reference channel		R.44 TDD	R.48 TDD					
Channel bandwidth	MHz	10	10					
Allocated resource blocks		50 (Note 4)	50 (Note					
			4)					
Uplink-Downlink Configuration		1	1					
(Note 3)								
Allocated subframes per Radio Frame (D+S)		3+2	3+2					
Modulation		64QAM	QPSK					
Target Coding Rate		1/2						
Information Bit Payload								
For Sub-Frames 4,9 (non CSI-RS	Bits	18336	N/A					
subframe)	2.10							
For Sub-Frames 4,9 (CSI-RS	Bits	16416	6200					
subframe)								
For Sub-Frames 1,6		11832	4264					
For Sub-Frame 5	Bits	N/A	N/A					
For Sub-Frame 0	Bits	14688	4968					
Number of Code Blocks per Sub-								
Frame								
(Note 5)								
For Sub-Frames 4,9 (non CSI-RS		3	2					
subframe)								
For Sub-Frames 4,9 (CSI-RS		3	2					
subframe)								
For Sub-Frames 1,6		2	1					
For Sub-Frame 5		N/A	N/A					
For Sub-Frame 0		3	1					
Binary Channel Bits Per Sub-								
Frame								
For Sub-Frames 4,9 (non CSI-RS	Bits	36000	12000					
subframe) For Sub-Frames 4,9 (CSI-RS	Bits	22600	11600					
	DIIS	33600	11600					
subframe) For Sub-Frames 1,6		23616	7872					
For Sub-Frame 5	Bits	N/A	N/A					
For Sub-Frame 0	Bits	29520	9840					
Max. Throughput averaged over 1	Mbps	7.1184	2.5896					
frame	ivibp3	7.1104	2.0000					
UE Category		≥ 2	≥1					
Note 1: 2 symbols allocated to PDCCH.								
Note 2: Reference signal, synchronization signals and PBCH								
allocated as per TS 36.211 [4].								
Note 3: as per Table 4.2-2 in TS 36.211 [4].								
	resource blocks (RB0–RB20 and RB30–RB49) are allocated							
in sub-frame 0 and the Dw								
Note 5: If more than one Code Blo								
sequence of L = 24 Bits is								
(otherwise $L = 0$ Bit).								

# Table A.3.4.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

### A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

	Parameter	Unit	Value				
Deference		Unit	R.50 TDD				
Reference		N 41 1-					
	pandwidth	MHz	10 50 (Nata 4)				
	resource blocks		50 (Note 4)				
	wnlink Configuration (Note		1				
3)							
	subframes per Radio		3+2				
Frame (D			0.001/				
Modulatio		-	QPSK				
	oding Rate		1/3				
	on Bit Payload						
	-Frames 4,9 (non CSI-RS	Bits	3624				
subframe	)						
	Frames 4,9 (CSI-RS	Bits	3624				
subframe							
	-Frames 1,6		2664				
	-Frame 5	Bits	N/A				
	-Frame 0	Bits	2984				
	of Code Blocks per Sub-						
Frame							
(Note 5)							
	-Frames 4,9 (non CSI-RS		1				
subframe	)						
	Frames 4,9 (CSI-RS		1				
subframe	/						
	-Frames 1,6		1				
	-Frame 5		N/A				
	-Frame 0		1				
Binary Ch	nannel Bits Per Sub-Frame						
	-Frames 4,9 (non CSI-RS	Bits	12000				
subframe	)						
	Frames 4,9 (CSI-RS	Bits	10400				
subframe							
	-Frames 1,6		7872				
	-Frame 5	Bits	N/A				
	-Frame 0	Bits	9840				
Max. Thro	oughput averaged over 1	Mbps	1.556				
frame							
UE Categ			≥ 1				
Note 1:							
Note 2:			als and PBCH				
allocated as per TS 36.211 [4].							
Note 3:	Note 3: as per Table 4.2-2 in TS 36.211 [4].						
Note 4:							
	41 resource blocks (RB0-R						
	allocated in sub-frame 0 and	d the DwPT	S portion of sub-				
	frames 1,6.	l. !=					
Note 5:	If more than one Code Bloc						
	CRC sequence of $L = 24$ Bi	ts is attache	ed to each Code				
	Block (otherwise $L = 0$ Bit).						

# Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

	Parameter	Unit	Val						
Referenc	e channel		R.45	R.45-1					
			TDD	TDD					
Channel	bandwidth	MHz	10	10					
Allocated	resource blocks		50 <sup>4</sup>	39					
Uplink-Do	ownlink Configuration (Note 3)		1	1					
Allocated	subframes per Radio Frame		4+2	4+2					
(D+S)									
Allocated	subframes per Radio Frame		10	10					
Modulation 16QAM 16QAM									
Target Coding Rate1/21/2									
	on Bit Payload								
	-Frames 4 and 9	Bits	N/A	N/A					
	SI-RS subframe)								
	-Frames 4 and 9	Bits	11448	8760					
(CSI-RS	subframe)		_						
	Frames 1,6	Bits	7736	7480					
	-Frame 5	Bits	N/A	N/A					
	-Frame 0	Bits	9528	8760					
	of Code Blocks per Sub-Frame	Bito	0020	0100					
(Note 5)									
	-Frames 4 and 9		N/A	N/A					
	SI-RS subframe)		1.1/7.1	1.1/7 (					
	Frames 4 and 9		2	2					
			2	2					
(CSI-RS subframe)       For Sub-Frames 1,6       2									
	-Frame 5		N/A	N/A					
	-Frame 0		2	2					
	nannel Bits Per Sub-Frame		L	2					
	-Frames 4 and 9	Bits	N/A	N/A					
	SI-RS subframe)	Dita	11/7	11/7					
	-Frames 4 and 9	Bits	22400	17472					
	S subframe)	Dita	22400	1/4/2					
	Frames 1,6	Bits	15744	14976					
	-Frame 5	Bits	N/A	N/A					
	-Frame 0	Bits	19680	18720					
	bughput averaged over 1 frame		4.7896	4.1240					
UE Categ		Mbps	4.7896 ≥2	4.1240 ≥1					
Note 1:	2 symbols allocated to PDCCH for								
Note 1.									
	BW; 3 symbols allocated to PDCCI allocated to PDCCH for 1.4 MHz. F								
	symbols are allocated to PDCCH 101 1.4 MHz. F		ao, only 2 OF						
Note 2:		signals and DE	RCH allocated	as nor TS					
NOLE Z.	Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].								
Note 3: As per Table 4.2-2 in TS 36.211 [4].									
Note 4:									
resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-									
	frame 0 and the DwPTS portion of sub-frames 1,6. For R.45-1, 39								
	resource blocks are allocated in sub-frames 0,4,9 and the DwPTS portion								
	of sub-frames 1,6 (RB0–RB20 and RB30–RB47).								
Note 5:				luence of					
1010 0.	Note 5: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each Code Block (otherwise $L = 0$ Bit).								
Note 6.				,.					
Note 6: Localized allocation started from RB #0 is applied.									

# A.3.5 Reference measurement channels for PDCCH/PCFICH performance requirements

## A.3.5.1 FDD

Parameter	Unit	Value										
Reference channel		R.15 FDD	R.15-1 FDD	R.15-2 FDD	R.16 FDD	R.17 FDD						
Number of transmitter antennas		1	2	2	2	4						
Channel bandwidth	MHz	10	10	10	10	5						
Number of OFDM symbols for PDCCH	symbols	2	3	2	2	2						
Aggregation level	CCE	8	8	8	4	2						
DCI Format		Format 1	Format 1	Format 1	Format 2	Format 2						
Cell ID		0	0	0	0	0						
Payload (without CRC)	Bits	31	31	31	43	42						

### Table A.3.5.1-1: Reference Channel FDD

### A.3.5.2 TDD

#### Table A.3.5.2-1: Reference Channel TDD

Parameter	Unit	Value									
Reference channel		R.15 TDD	R.15-1 TDD	R.15-2 TDD	R.16 TDD	R.17 TDD					
Number of transmitter antennas		1	2	2	2	4					
Channel bandwidth	MHz	10	10	10	10	5					
Number of OFDM symbols for PDCCH	symbols	2	3	2	2	2					
Aggregation level	CCE	8	8	8	4	2					
DCI Format		Format 1	Format 1	Format 1	Format 2	Format 2					
Cell ID		0	0	0	0	0					
Payload (without CRC)	Bits	34	34	34	46	45					

# A.3.6 Reference measurement channels for PHICH performance requirements

### Table A.3.6-1: Reference Channel FDD/TDD

	Parameter	Unit		Value	;	
Referenc	e channel		R.18	R.19	R.20	R.24
Number	of transmitter antennas		1	2	4	1
Channel	bandwidth	MHz	10	10	5	10
User role	s (Note 1)		W I1 I2	W I1 I2	W I1 I2	W I1
Resource allocation (Note 2)			(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1)
Power of	fsets (Note 3)	dB	-4 0 -3	-4 0 -3	-4 0 -3	+3 0
Payload	(Note 4)		ARR	ARR	ARR	A R
Note 1: Note 2: Note 3:	W=wanted user, I1=interf The resource allocation p The power offsets (per us relative to the first interfer	er user is g er) repres	given as (N_group_	PHICH, N_seq_PH		l per PHICH

Note 4: A=fixed ACK, R=random ACK/NACK.

# A.3.7 Reference measurement channels for PBCH performance requirements

### Table A.3.7-1: Reference Channel FDD/TDD

Parameter	Unit	Value					
Reference channel		R.21	R.22	R.23			
Number of transmitter antennas		1	2	4			
Channel bandwidth	MHz	1.4	1.4	1.4			
Modulation		QPSK	QPSK	QPSK			
Target coding rate		40/1920	40/1920	40/1920			
Payload (without CRC)	Bits	24	24	24			

# A.3.8 Reference measurement channels for MBMS performance requirements

### A.3.8.1 FDD

Parameter			Р	мсн			
	Unit			Va	lue		
Reference channel		R.40 FDD			R.37 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Allocated subframes per Radio Frame (Note 1)		6			6		
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits	408			3624		
For Sub-Frames 0,4,5,9	Bits	N/A			N/A		
Number of Code Blocks per Subframe (Note 3)		1			1		
Binary Channel Bits Per Subframe		•					
For Sub-Frames 1,2,3,6,7,8	Bits	1224			10200		
For Sub-Frames 0,4,5,9	Bits	N/A			N/A		
MBMS UE Category		≥ 1			≥ 1		
Note 1: For FDD mode, up to 6 sub 36.331.	oframes (#	±1/2/3/6/7/8) ar	e avail	able fo	r MBMS, in lin	e with	TS
Note 2: 2 OFDM symbols are reser 36.211.				Ū			
Note 3: If more than one Code Bloo attached to each Code Bloo			nal CR0	C sequ	ence of L = 24	4 Bits is	3

#### Table A.3.8.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	РМСН							
	Unit	Value						
Reference channel					R.38 FDD			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks					50			
Allocated subframes per Radio Frame (Note 1)					6			
Modulation					16QAM			
Target Coding Rate					1/2			
Information Bit Payload (Note 2)								
For Sub-Frames 1,2,3,6,7,8	Bits				9912			
For Sub-Frames 0,4,5,9	Bits				N/A			
Number of Code Blocks per Subframe (Note 3)					2			
Binary Channel Bits Per Subframe								
For Sub-Frames 1,2,3,6,7,8	Bits				20400			
For Sub-Frames 0,4,5,9	Bits				N/A			
MBMS UE Category					≥ 1			
Note 1: For FDD mode, up to 6 subframes (#1 36.331.	/2/3/6/7/	8) are	availal	ble for	MBMS, in lin	e with	TS	
Note 2: 2 OFDM symbols are reserved for PD 36.211.	CCH; an	d refer	ence s	signal	allocated as p	er TS		
Note 3: If more than one Code Block is preser attached to each Code Block (otherwi			CRC	seque	ence of L = 24	Bits is	1	

Table A.3.8.1-2: Fixed Reference Channel 16QAM R=1/2

### Table A.3.8.1-3: Fixed Reference Channel 64QAM R=2/3

Parameter	РМСН									
	Unit	Value								
Reference channel				R.39-1 FDD	R.39 FDD					
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks				25	50					
Allocated subframes per Radio Frame(Note1)				6	6					
Modulation				64QAM	64QAM					
Target Coding Rate				2/3	2/3					
Information Bit Payload (Note 2)				1	I.					
For Sub-Frames 1,2,3,6,7,8	Bits			9912	19848					
For Sub-Frames 0,4,5,9	Bits			N/A	N/A					
Number of Code Blocks per Sub-Frame (Note 3)				2	4					
Binary Channel Bits Per Subframe				1	•					
For Sub-Frames 1,2,3,6,7,8	Bits			15300	30600					
For Sub-Frames 0,4,5,9	Bits			N/A	N/A					
MBMS UE Category				≥1	≥ 2					
Note 1:For FDD mode, up to 6 subframes (#1/2/3,Note 2:2 OFDM symbols are reserved for PDCCHNote 3:If more than one Code Block is present, arCode Block (otherwise L = 0 Bit).	l; and refere	ence sig	nal all	ocated as p	er TS 36.211.		ach			

## A.3.8.2 TDD

Parameter				РМСН				
	Unit		Value					
Reference channel		R.40 TDD			R.37 TDD			
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6			50			
Uplink-Downlink Configuration(Note 1)		5			5			
Allocated subframes per Radio Frame		5			5			
Modulation		QPSK			QPSK			
Target Coding Rate		1/3			1/3			
Information Bit Payload (Note 2)								
For Sub-Frames 3,4,7,8,9	Bits	408			3624			
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A			
Number of Code Blocks per Subframe		1			1			
(Note 3)								
Binary Channel Bits Per Subframe					-			
For Sub-Frames 3,4,7,8,9	Bits	1224			10200			
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A			
MBMS UE Category		≥ 1			≥ 1			
Note 1: For TDD mode, in line with TS 36	.331, Up	link-Downlink	Config	uratior	n 5 is propose	d, up to	o 5	
subframes (#3/4/7/8/9) are availal	ole for M	BMS.						
Note 2: 2 OFDM symbols are reserved for	r PDCCH	H; reference si	ignal al	locate	d as per TS 30	5.211.		
Note 3: If more than one Code Block is pr	esent, ai	n additional C	RC sec	quence	e of L = 24 Bits	s is atta	ached	
to each Code Block (otherwise L :	= 0 Bit).							

### Table A.3.8.2-1: Fixed Reference Channel QPSK R=1/3

Table A.3.8.2-2: Fixed Reference Channel 16QAM R=1/2

Parameter				PMC	СН		
	Unit				Value		
Reference channel					R.38 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Uplink-Downlink Configuration(Note 1)					5		
Allocated subframes per Radio Frame					5		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits				9912		
For Sub-Frames 0,1,2,5,6	Bits				N/A		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits				20400		
For Sub-Frames 0,1,2,5,6	Bits				N/A		
MBMS UE Category					≥ 1		
Note 1: For TDD mode, in line with TS 36.331	, Uplink-l	Downlin	k Con	figura	tion 5 is prop	osed, I	up to
5 subframes (#3/4/7/8/9) are available							
Note 2: 2 OFDM symbols are reserved for PD							
Note 3: If more than one Code Block is preser			CRC s	seque	nce of $L = 24$	Bits is	
attached to each Code Block (otherwi	se L = 0	Bit).					

attached to each Code Block (otherwise L = 0 Bit).

Parameter	РМСН									
	Unit	Value								
Reference channel				R.39-1TDD	R.39 TDD					
Channel bandwidth	MHz	1.4	3	5	10	15	20			
Allocated resource blocks				25	50					
Uplink-Downlink Configuration(Note 1)				5	5					
Allocated subframes per Radio Frame				5	5					
Modulation				64QAM	64QAM					
Target Coding Rate				2/3	2/3					
Information Bit Payload (Note 2)										
For Sub-Frames 3,4,7,8,9	Bits			9912	19848					
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A					
Number of Code Blocks per Sub-Frame (Note 3)				2	4					
Binary Channel Bits Per Subframe										
For Sub-Frames 3,4,7,8,9	Bits			15300	30600					
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A					
MBMS UE Category				≥ 1	≥ 2					
Note 1:For TDD mode, in line with TS subframes (#3/4/7/8/9) are avaNote 2:2 OFDM symbols are reservedNote 3:If more than one Code Block is attached to each Code Block (	ailable for for PDC s present	r MBMS CH; re , an ad	S. ferenc ditiona	ce signal allocat	ed as per TS 3	36.211				

# A.3.9 Reference measurement channels for sustained downlink data rate provided by lower layers

### A.3.9.1 FDD

### Table A.3.9.1-1: Fixed Reference Channel for sustained data-rate test (FDD)

Parameter	Unit				Va	lue			
Reference channel		R.31-1	R.31-2	R.31-3	R.31-3A	R.31-3C	R.31-4	R.31-4B	R.31-5
		FDD	FDD	FDD	FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 10	Note 7	Note 11	Note 9
Allocated subframes per Radio		10	10	10	10	10	10	10	10
Frame									
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate									
For Sub-Frame 1,2,3,4,6,7,8,9,		0.40	0.59	0.59	0.85	0.87	0.88	0.85	0.85
For Sub-Frame 5		0.40	0.64	0.62	0.89	0.88	0.87	0.87	0.91
For Sub-Frame 0		0.40	0.63	0.61	0.90	0.91	0.90	0.88	0.88
Information Bit Payload (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056	55056
Number of Code Blocks									
(Notes 3 and 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9	9
Binary Channel Bits (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352	62352
Number of layers		1	2	2	2	2	2	2	2
Max. Throughput averaged over 1	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826	54.826
frame (Note 8) UE Categories		≥ 1	≥ 2	≥ 2	≥2	≥ 3	≥ 3	≥ 4	≥ 3
Note 1: 1 symbol allocated to PDC	°C⊔ for a		22	22	<u> </u>	23	20	≤ 4	20
Note 2: Reference signal, synchro				operad on r	or TO 26 2	14 [4]			
Note 3: If more than one Code Blo							chad ta aa	ch Code Bl	ock
(otherwise $L = 0$ Bit).		sent, an au		to sequen	UE 01 L - 24				UCK
Note 4: Resource blocks $n_{PRB} = 0$ .	2 are allo	ocated for S	SIR transm	nissions in a	sub-frame 5	for all hand	dwidths		
Note 5: Resource blocks $n_{PRB} = 6$ .									
Note 6: Resource blocks $n_{PRB} = 3$							blocks n⊳	RB = 0.49 ir	n sub-
frames 0,1,2,3,4,6,7,8,9.							2.0010 HF		
Note 7: Resource blocks $n_{PRB} = 4$	99 are a	llocated fo	r the user o	data in sub	-frame 5. a	nd resource	blocks n⊳	<sub>вв</sub> = 099 ir	n sub-
frames 0,1,2,3,4,6,7,8,9.							· · · · · · · · · · · ·		
Note 8: Given per component carr	ier per co	deword.							
Note 9: Resource blocks nPRB = 474 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 074 in sub-									

frames 0,1,2,3,4,6,7,8,9.

Note 10: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 11: Resource blocks n<sub>PRB</sub> = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n<sub>PRB</sub> = 0..74 in subframes 0,1,2,3,4,6,7,8,9.

# A.3.9.2 TDD

Parameter	Unit			Value			
Reference channel	Unit	R.31-1	R.31-2	R.31-3	R.31-3A	R.31-4	
		TDD	TDD	TDD	TDD	TDD	
Channel bandwidth	MHz	10	10	20	15	20	
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	Note 8	
Uplink-Downlink Configuration (Note 3)		5	5	5	1	1	
Number of HARQ Processes per	Proces	15	15	15	7	7	
component carrier	ses	15	10	15	'	'	
Allocated subframes per Radio Frame	000	8+1	8+1	8+1	4	4	
(D+S)		0.1	0.1	011			
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		01001	0100/111	0100101	0100	0.100.100	
For Sub-Frames 4,9		0.40	0.59	0.59	0.87	0.88	
For Sub-Frames 3,7,8		0.40	0.59	0.59	N/A	N/A	
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A	
For Sub-Frames 5		0.40	0.64	0.62	0.88	0.87	
For Sub-Frames 6		0.40	0.60	0.60	N/A	N/A	
For Sub-Frames 0		0.40	0.62	0.61	0.90	0.90	
Information Bit Payload		0.10	0.02	0.01	0.00	0.00	
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376	
For Sub-Frames 3,7,8	Bits	10296	25456	51024	0	0	
For Sub-Frame 1	Bits	0	0	0	0	0	
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112	
For Sub-Frame 6	Bits	10296	25456	51024	0	0	
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376	
Number of Code Blocks per Sub-Frame	Dito	10230	20400	01024	01024	10010	
(Note 4)							
For Sub-Frames 4,9		2	5	9	9	13	
For Sub-Frames 3,7,8		2	5	9	N/A	N/A	
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 5		2	5	9	9	12	
For Sub-Frame 6	Bits	2	5	9	n/a	N/A	
For Sub-Frame 0	Bito	2	5	9	9	13	
Binary Channel Bits Per Sub-Frame			Ŭ	Ŭ		10	
For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400	
For Sub-Frames 3,7,8	Bits	26100	43200	86400	0	0	
For Sub-Frame 1	Bits	0	0	0	0	0	
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512	
For Sub-Frame 6	Bits	26100	42768	85968	N/A	N/A	
For Sub-Frame 0	Bits	26100	41184	84384	56736	84384	
Number of layers	Bito	1	2	2	2	2	
Max. Throughput averaged over 1 frame	Mbps	8.237	20.365	40.819	20.409	29.724	
(Note 10)	mopo	0.201	20.000	10.010	201100	201121	
UE Category		≥ 1	≥ 2	≥2	≥2	≥ 3	
Note 1: 1 symbol allocated to PDCCH for	r all tests	. – ·					
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].							
Note 3: As per Table 4.2-2 in TS 36.211 [4].							
Note 4: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached							
to each Code Block (otherwise L			1 •				
Note 5: Resource blocks $n_{PRB} = 02$ are		or SIB tran	smissions	in sub-fram	ne 5 for all		
bandwidths.			-				
Note 6: Resource blocks $n_{PRB} = 614,3049$ are allocated for the user data in all subframes.							
Noto 7: Resource blocks n=== - 2, 40 or				ula franca C			

Note 7: Resource blocks n<sub>PRB</sub> = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n<sub>PRB</sub> = 0..49 in sub-frames 0,3,4,6,7,8,9.

Note 8: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,3,4,6,7,8,9.

Note 9: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in all sub-frames

Note10: Given per component carrier per codeword.

## A.3.9.3 FDD (EPDCCH scheduling)

### Table A.3.9.3-1: Fixed Reference Channel for sustained data-rate test with EPDCCH scheduling (FDD)

Deveryofter	1124				V-L.			
Parameter	Unit	DOIE	DOIE	DALE	Value		DOIE	
Reference channel		R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-4B
Oh ann al h an duidth	N 41 1-	1 FDD	2 FDD	3 FDD	3A FDD	3C FDD	4 FDD	FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 9	Note 7	Note 10
Allocated subframes per Radio Frame		10	10	10	10	10	10	10
Modulation		64QAM						
Coding Rate								
(subframes with PDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.3972	0.5926	0.5933	0.8533	0.8725	0.8763	0.8533
For Sub-Frame 5		0.3972	0.6441	0.6246	0.8889	0.8855	0.8702	0.8762
For Sub-Frame 0		0.3972	0.6282	0.6106	0.9046	0.9105	0.9018	0.8868
Coding Rate								
(subframes with EPDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.4114	0.6047	0.5993	0.8707	0.8855	0.8851	0.8649
For Sub-Frame 5		0.4114	0.6584	0.6312	0.9086	0.8990	0.8794	0.8889
For Sub-Frame 0		0.4114	0.6418	0.6170	0.9242	0.9246	0.9112	0.8993
Information Bit Payload (Note 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056
Number of Code Blocks								
(Notes 3 and 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9
Binary Channel Bits (Note 8)								
(subframes with PDCCH USS								
monitoring)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352
Binary Channel Bits (Note 8)								
(subframes with EPDCCH USS								
monitoring)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	25200	42336	85536	42336	57888	85536	63936
For Sub-Frame 5	Bits	25200	38880	81216	38880	57024	81216	59616
For Sub-Frame 0	Bits	25200	39888	83088	39888	55440	83088	61488
Number of layers		1	2	2	2	2	2	2
Max. Throughput averaged over 1	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826
frame (Note 8)		_						
UE Categories		≥1	≥2	≥2	≥2	≥ 3	≥ 3	≥ 4
Note 1: 1 symbol allocated to PDCCH	for all t	aete	•			-	-	

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Resource blocks n<sub>PRB</sub> = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 5: Resource blocks n<sub>PRB</sub> = 6..14,30..49 are allocated for the user data in all sub-frames.

Note 6: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,1,2,3,4,6,7,8,9.

Note 7: Resource blocks n<sub>PRB</sub> = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n<sub>PRB</sub> = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Note 8: Given per component carrier per codeword.

Note 9: Resource blocks n<sub>PRB</sub> = 4..71 are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 10: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in sub-frames 0,1,2,3,4,6,7,8,9.

# A.3.9.4 TDD (EPDCCH scheduling)

### Table A.3.9.4-1: Fixed Reference Channel for sustained data-rate with EPDCCH scheduling (TDD)

Parameter	Unit			Value		
Reference channel	•••••	R.31E-1	R.31E-2	R.31E-3	R.31E-3A	R.31E-4
		TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	10	10	20	15	20
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	Note 8
Uplink-Downlink Configuration (Note 3)		5	5	5	1	1
Number of HARQ Processes per component carrier	Processes	15	15	15	7	7
Allocated subframes per Radio		8+1	8+1	8+1	4	4
Frame (D+S) Coding Rate (subframes with PDCCH USS monitoring)						
For Sub-Frames 4,9		0.3972	0.5926	0.5933	0.8725	0.8763
For Sub-Frames 3,7,8		0.3972	0.5926	0.5933	N/A	N/A
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.3972	0.6372	0.6213	0.8790	0.8656
For Sub-Frames 6		0.3972	0.5986	0.5963	N/A	N/A
For Sub-Frames 0		0.3972	0.6216	0.6075	0.9036	0.8972
Coding Rate (subframes with EPDCCH USS monitoring)						
For Sub-Frames 4,9		0.4114	0.6047	0.5993	0.8856	0.8851
For Sub-Frames 3,7,8		0.4114	0.6047	0.5993	N/A	N/A
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.4114	0.6512	0.6279	0.8922	0.8748
For Sub-Frames 6		0.4114	0.6109	0.6024	N/A	N/A
For Sub-Frames 0		0.4114	0.6349	0.6138	0.9175	0.9065
Information Bit Payload						
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376
For Sub-Frames 3,7,8	Bits	10296	25456	51024	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112
For Sub-Frame 6	Bits	10296	25456	51024	N/A	N/A
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376
Number of Code Blocks per Sub- Frame (Note 4)						
For Sub-Frames 4,9		2	5	9	9	13
For Sub-Frames 3,7,8		2	5	9	N/A	N/A
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5	Dit	2	5	9	9	12
For Sub-Frame 6	Bits	2	5	9	N/A	N/A
For Sub-Frame 0 Binary Channel Bits per Sub-Frame (subframes with PDCCH USS monitoring)		2	5	9	9	13
For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400
For Sub-Frames 3,7,8	Bits	26100	43200	86400	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512
For Sub-Frame 6	Bits	26100	42768	85968	N/A	N/A
For Sub-Frame 0 Binary Channel Bits per Sub-Frame	Bits	26100	41184	84384	56736	84384
(subframes with EPDCCH USS monitoring)						
For Sub-Frames 4,9	Bits	25200	42336	85536	57888	85536
For Sub-Frames 3,7,8	Bits	25200	42336	85536	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	25200	39312	81648	57456	81648
For Sub-Frame 6	Bits	25200	41904	85104	N/A	N/A

For Sub	-Frame 0	Bits	25200	40320	83520	55872	83520				
Number of	of layers		1	2	2	2	2				
Max. Thro	oughput averaged over 1	Mbps	8.237	20.365	40.819	20.409	29.724				
frame (No	ote 10)	-									
UE Categ	jory		≥ 1	≥2	≥2	≥ 2	≥ 3				
Note 1:	1 symbol allocated to PDCC	H for all tests									
Note 2:	Reference signal, synchroni	zation signals	and PBCH al	located as pe	r TS 36.211 [4	].					
Note 3:	As per Table 4.2-2 in TS 36.	211 [4].									
Note 4:	If more than one Code Block	k is present, a	is present, an additional CRC sequence of L = 24 Bits is attached to each Code								
	Block (otherwise $L = 0$ Bit).										
Note 5:	Resource blocks n <sub>PRB</sub> = 02	are allocated for SIB transmissions in sub-frame 5 for all bandwidths.									
Note 6:	Resource blocks n <sub>PRB</sub> = 61	4,3049 are allocated for the user data in all subframes.									
Note 7:	Resource blocks n <sub>PRB</sub> = 34	9 are allocate	d for the user	data in sub-fra	ame 5, and re	source blocks r	$n_{PRB} = 049$				
	in sub-frames 0,3,4,6,7,8,9.										
Note 8:	e 8: Resource blocks n <sub>PRB</sub> = 499 are allocated for the user data in sub-frame 5, and resource blocks n <sub>PRB</sub> = 099										
in sub-frames 0,3,4,6,7,8,9.											
Note 9:	Resource blocks n <sub>PRB</sub> = 47	71 are allocated for the user data in all sub-frames									
Note10:	Given per component carrie	r per codewoi	d.								

# A.3.10 Reference Measurement Channels for EPDCCH performance requirements

A.3.10.1 FDD

#### Table A.3.10.1-1: Reference Channel FDD

Parameter	Unit			Value	e		
Reference channel		R.55 FDD	R.56 FDD	R.57 FDD	R.58 FDD	R.59 FDD	
Number of transmitter antennas		2	2	2	2	2	
Channel bandwidth	MHz	10	10	10	10	10	
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	
Aggregation level	ECCE	4	16	2	8	2	
DCI Format		2A	2A	2C	2C	2D	

## A.3.10.2 TDD

#### Table A.3.10.2-1: Reference Channel TDD

Parameter	Unit			Value			
Reference channel		R.55 TDD	R.56 TDD	R.57 TDD	R.58 TDD	R.59 TDD	
Number of transmitter antennas		2	2	2	2	2	
Channel bandwidth	MHz	10	10	10	10	10	
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	
Aggregation level	CCE	4	16	2	8	2	
DCI Format		2A	2A	2C	2C	2D	

## A.4 CSI reference measurement channels

This section defines the DL signal applicable to the reporting of channel status information (Clause 9.2, 9.3 and 9.5).

In Table A.4-1 are specified the reference channels. Table A.4-13 specifies the mapping of CQI index to modulation coding scheme, which complies with the CQI definition specified in Section 7.2.3 of [6].

Table A.4-0: Void

RMC Name	Duplex	CH-BW	Alloc. RB-s	UL/DL Config	Alloc. SF-s	MCS Scheme	Nr. HARQ Proc.	Max. nr HARQ Trans.	Notes
1 CRS Port									
RC.1 FDD	FDD	10	50	-		MCS.1	8	1	
RC.1 TDD	TDD	10	50	Note 3		MCS.1	10	1	
RC.3 FDD	FDD	10	6	-		MCS.10	8	1	
RC.3 TDD	TDD	10	6	Note 3		MCS.10	10 or 7 (Note 8)	1	
RC.4 FDD	FDD	10	15	-		MCS.15	8	1	Note 6
RC.4 TDD	TDD	10	15	Note 3		MCS.15	10	1	Note 6
RC.5 FDD	FDD	10	3	-		MCS.17	8	1	
RC.5 TDD	TDD	10	3	Note 3		MCS.17	10	1	
2 CRS Ports									
RC.2 FDD	FDD	10	50	-		MCS.2	8	1	
RC.2 TDD	TDD	10	50	Note 3		MCS.2	10 or 7 (Note 8)	1	
RC.6 FDD	FDD	10	15	-		MCS.16	8	1	Note 6
RC.6 TDD	TDD	10	15	Note 3		MCS.16	7	1	Note 6
				1 CRS Por	t + CSI-RS				
RC.8 FDD	FDD	10	6	_	Non CSI-RS	MCS.11	8	1	
KC.0 FDD	rbb	10	0	-	2 CSI-RS	MCS.12	. 0		
RC.8 TDD	TDD	10	6	Note 3	Non CSI-RS	MCS.11	10	1	
					2 CSI-RS	MCS.12			
RC.9 FDD	FDD	10	50	-	Non CSI-RS	MCS.3	8	1	
					2 CSI-RS	MCS.4			
RC.9 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.3	7	1	
					2 CSI-RS	MCS.4			
2 CRS Port	+ CSI-RS	Γ	Γ	T	1 ••	ľ	Γ	T	
RC.7 FDD	FDD	10	50	-	Non CSI-RS	MCS.5	8	1	
					4 CSI-RS	MCS.7			
RC.7 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.5	10	1	
					8 CSI-RS	MCS.8			
RC.11 FDD	FDD	10	50	_	Non CSI-RS	MCS.5	8	1	
					2 CSI-RS	MCS.6	Ũ		
RC.11 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.5	10	1	
KC.TITDD	TUU	10	50	Note 5	2 CSI-RS	MCS.6	10	1	
1 CRS Port	+ CSI-RS	+ CSI-IM						·	
					Non CSI- RS/IM	MCS.3			
RC.13 FDD	FDD	10	50	-	CSI- RS/IM	N/A	8	1	
					Non CSI- RS/IM	MCS.3			
RC.13 TDD	TDD	10	50	Note 3	CSI- RS/IM	N/A	10	1	
2 CRS Port	+ CSI-RS	+ CSI-IM	I	I		I	1	I	
					Non CSI-RS	MCS.5			
RC.10 FDD	FDD	10	50	-	4 CSI-	MCS.8	8	1	
					RS,	-			

#### Table A.4-1: CSI reference measurement channels

					1 CSI process				
					Non CSI-RS	MCS.5			
RC.10 TDD	TDD	10	50	Note 3	8 CSI- RS, 1 CSI process	MCS.9	10	1	
		40	0		Non CSI- RS/IM	MCS.13			
RC.12 FDD	FDD	10	6	-	CSI- RS/IM	N/A	8	1	
RC.12 TDD	TDD	10	6	Note 3	Non CSI- RS/IM	MCS.13	10	1	
KC.12 TDD	ססי	10	0	Note 5	CSI- RS/IM	N/A	10	I	
Note 1: 3	symbols a	llocated to	PDCCH.						
Note 2: F	or FDD on	ly subframe	es 1, 2, 3, 4	, 6, 7, 8 and	9 are alloca	ated to avoid	d PBCH and	d synchroni	zation
	gnal overh								
Note 3: T	Note 3: TDD UL-DL configuration as specified in the individual tests.								

Note 3: Note 4: For TDD when UL-DL configuration 1 is used only subframes 4 and 9 are allocated to avoide PBCH and synchronizaiton signal overhead.

Note 5: For TDD when UL-DL configuration 2 is used only subframes 3, 4, 8, and 9 are allocated to avoid PBCH and synchronization signal overhead.

Centered within the Transmission Bandwidth Configuration (Figure 5.6-1). Note 6:

Only subframes 2, 3, 4, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead. The number of HARQ processes is 10 for TDD UL/DL configuration 2 and 7 for TDD UL/DL Note 7:

Note 8: configuration 1.

Table A.4-1a: Void
Table A.4-1b: Void
Table A.4-1c: Void
Table A.4-1d: Void
Table A.4-1e: Void
Table A.4-2: Void
Table A.4-2a: Void
Table A.4-2b: Void
Table A.4-2c: Void
Table A.4-2d: Void
Table A.4-2e: Void
Table A.4-3: Void
Table A.4-3a: Void
Table A.4-3b: Void
Table A.4-3c: Void
Table A.4-3d: Void
Table A.4-3e: Void
Table A.4-3f: Void
Table A.4-3g: Void
Table A.4-3h: Void
Table A.4-3i: Void
Table A.4-3j: Void
Table A.4-3k: Void
Table A.4-31: Void
Table A.4-4: Void
Table A.4-4a: Void
Table A.4-4b: Void
Table A.4-5: Void
Table A.4-5a: Void

Table A.4-5b: Void

Table A.4-6a: Void Table A.4-6b: Void

Table A.4-6: Void

Table A.4-6c: Void

Table A.4-6d: Void

Table A.4-6e: Void

Table A.4-6f: Void

Table A.4-7: Void

Table A.4-8: Void

Table A.4-9: Void

Table A.4-10: Void

Table A.4-11: Void

Table A.4-12: Void

#### Table A.4-13: Mapping of CQI Index to Modulation coding scheme (MCS)

0	QI Inde	X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Targe	t Codin	g Rate	OOR	0.0762	0.1172	0.1885	0.3008	0.4385	0.5879	0.3691	0.4785	0.6016	0.6016 0.4551 0.5537 0.5537 0.5504 0.7539 0.7539 0.8525			Notes			
M	odulati	on	OOR			QP	SK			1	6QAN	Λ			64C	AM			
MCS Scheme	PRB	Available RE-s		Imcs															
MCS.1	50	6300	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.2	50	6000	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.3	50	5700	DTX	0	0	2	4	6	8	10	13	15	17	19	21	23	25	26	
MCS.4	50	5600	DTX	0	0	2	4	6	7	10	12	14	17	19	21	23	25	26	
MCS.5	50	5400	DTX	0	0	2	3	5	7	10	12	14	17	19	21	23	24	25	
MCS.6	50	5300	DTX	0	0	1	3	5	7	10	12	14	17	19	21	22	24	25	
MCS.7	50	5200	DTX	0	0	1	3	5	7	10	12	14	17	18	20	22	24	25	
MCS.8	50	5000	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.9	50	4800	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.10	6	756	DTX	0	0	2	4	6	8	11	13	16	19	21	23	25	27	27	
MCS.11	6	684	DTX	0	0	2	4	6	8	11	13	14	17	20	21	23	25	27	
MCS.12	6	672	DTX	0	0	1	4	6	8	10	12	14	17	19	21	23	25	26	
MCS.13	6	648	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.14	25	3150	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.15	15	1890	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.16	15	1800	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.17	3	378	DTX	0	1	2	5	7	9	12	13	16	19	21	23	25	27	27	
Note 1: Note 2: Note 3:	Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6]. 3 symbols allocated to PDCCH. Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.																		
	#6) sh	all be used	for pote	ential	retra	nsmi	ssion	s.											

## A.5 OFDMA Channel Noise Generator (OCNG)

## A.5.1 OCNG Patterns for FDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

 $\gamma_i = PDSCH_i \_ RA / OCNG \_ RA = PDSCH_i \_ RB / OCNG \_ RB,$ 

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for each CC.

## A.5.1.1 OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

		Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dl	B]						
	Subframe								
	0 5 1-4,6-9								
		Allocation		Data					
First u	unallocated PRB	First unallocated PRB	First unallocated PRB						
Last u	unallocated PRB	Last unallocated PRB	Last unallocated PRB						
	0	0	0	Note 1					
Note 1:			arbitrary number of virtual UEs wit PDSCHs shall be uncorrelated ps						
	data, which is QPS	K modulated. The parameter ${\gamma}_{_{Pl}}$	$_{_{R\!B}}$ is used to scale the power of PI	DSCH.					
Note 2:			I in the test, the OCNG shall be tra RS according to transmission mod						
	parameter $\gamma_{\scriptscriptstyle PRB}$ ap	plies to each antenna port separ	ately, so the transmit power is equi	ual between all					
	the transmit antenn section 7.1 in 3GPF		e antenna transmission modes ar	e specified in					

Table A.5.1.1-1: OP.1 FDD: One sided dynamic OCNG FDD Pattern

## A.5.1.2 OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{_{RB}}-1$ .

	R	Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dE	3]							
		Subframe								
	0									
		Allocation		PDSCH Data						
0 – (First	t allocated PRB-1)	0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	1 Doorn Data						
	and	and	and							
(Last all	located PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –							
(	$(N_{RB} - 1)$	$(N_{RB} - 1)$	$(N_{RB} - 1)$							
	0	0	0	Note 1						
Note 1:		ource blocks are assigned to a nitted over the OCNG PDSCH								
	modulated. The pa	rameter $\gamma_{\scriptscriptstyle PRB}$ is used to scale t	he power of PDSCH.							
Note 2:	If two or more trans	smit antennas with CRS are us	ed in the test, the OCNG shall b	be transmitted to the virtual						
	users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies									
		ort separately, so the transmit p ne antenna transmission modes								

#### Table A.5.1.2-1: OP.2 FDD: Two sided dynamic OCNG FDD Pattern

## A.5.1.3 OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

		Re	lative power	evel $\gamma_{\scriptscriptstyle PRB}$ [d	B]			
Alloc			Subframe					
$n_P$	RB	0	5	4, 9	1 - 3, 6 - 8	Data	Data	
1 –	49	0 (Allocation: 0 N/A all empty PRB-s)		Note 1	N/A			
0 —	49	N/A	N/A	0	N/A	Note 2		
Note 1: Note 2: Note 3:	one PDS uncorrel used to Each ph each PF measure contain paramet If two or the virtu	hysical resource SCH per virtual lated pseudo ra scale the powe sysical resource B shall be unce ement. The MB cell-specific Re ter $\gamma_{PRB}$ is used more transmit al users by all to power shall be	UE; the data t ndom data, wh r of PDSCH. block (PRB) i orrelated with SFN data shal ference Signal to scale the p antennas are he transmit an	ransmitted over hich is QPSK r s assigned to I data in other P I be QPSK mo is only in the fil ower of PMCH used in the tes tennas accord	er the OCNG F nodulated. The MBSFN transn RBs over the dulated. PMCI rst symbol of the t, the OCNG s ing to transmis	PDSCHs sh e paramete nission. The period of al H subframe he first time hall be transsion mode	all be $\gamma \gamma_{PRB}$ is e data in my es shall e slot. The msmitted to e 2. The	
N/A:	Not App	enna transmiss Iicable	ion modes are	specified in se	ection 7.1 in 30	JPP 18 36	.213.	

#### Table A.5.1.3-1: OP.3 FDD: OCNG FDD Pattern 3

## A.5.1.4 OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

		Re	lative power l	evel $\gamma_{\scriptscriptstyle PRB}$ [dB]				
Alloca			Subfr	ame	PDSCH Data	PMCH Data		
$n_{PI}$	RB	0, 4, 9	5	1 – 3, 6 – 8	Data	Data		
First unallocated PRB – Last unallocated PRB		0 (Allocation: N/A all empty PRB-s)		N/A	Note 1	N/A		
First una PR – Last una PR	B llocated	N/A	N/A	N/A	N/A	Note 2		
Note 1:				ssigned to an arbitrary numb ransmitted over the OCNG P				
	uncorrel	ated pseudo ra	ndom data, wh	nich is QPSK modulated. The	e paramete	r $\gamma_{_{PRB}}$ is		
Note 2:	Each ph each PR measure	B shall be unc ement. The MB	block (PRB) is orrelated with o SFN data shall	s assigned to MBSFN transn data in other PRBs over the p be QPSK modulated. PMCI s only in the first symbol of tl	period of ar H subframe	ny es shall		
	paramet	er $\gamma_{\scriptscriptstyle PRB}$ is used	I to scale the p	ower of PMCH.				
Note 3:	te 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.							
N/A:	Not App	licable						

Table A.5.1.4-1: OP.4 FDD: One sided dynamic OCNG FDD Pattern for MBMS transmission

## A.5.1.5 OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of DL sub-frames, when the unallocated area is continuous in the frequency domain (one sided).

		Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dl	B]						
	Subframe								
	0 5 1-4,6-9								
		Allocation		Data					
First u	unallocated PRB	First unallocated PRB	First unallocated PRB						
Last u	unallocated PRB	Last unallocated PRB	Last unallocated PRB						
	0	0	0	Note 1					
Note 1:			arbitrary number of virtual UEs wit PDSCHs shall be uncorrelated ps						
	data, which is 16QA	AM modulated. The parameter $\gamma$	PRB is used to scale the power of F	PDSCH.					
Note 2:	Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large								
	Delay CDD). The pa	arameter ${\gamma}_{_{PRB}}$ applies to each a	antenna port separately, so the tra	nsmit power is					
		ne transmit antennas with CRS u d in section 7.1 in 3GPP TS 36.2	used in the test. The antenna trans 213.	smission					

#### Table A.5.1.5-1: OP.5 FDD: One sided dynamic 16QAM modulated OCNG FDD Pattern

## A.5.1.6 OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{RB} - 1$ .

	R					
	0					
		Allocation				
0 – (Firs	t allocated PRB of	0 – (First allocated PRB of	0 – (First allocated PRB of	PDSCH Data		
fir	rst block -1)	first block -1)	first block -1)			
	and	and	and			
<b>`</b>	ocated PRB of first	(Last allocated PRB of first	(Last allocated PRB of first			
	) – (First allocated	block +1) – (First allocated	block +1) – (First allocated			
PRB of	second block -1)	PRB of second block -1)	PRB of second block -1)			
	0	0	0	Note 1		
Note 1:		ource blocks are assigned to an nitted over the OCNG PDSCHs				
	modulated. The pa	rameter ${\gamma}_{\scriptscriptstyle PRB}$ is used to scale the sc	he power of PDSCH.			
Note 2:	If two or more trans	ed in the test, the OCNG shall t	be transmitted to the virtual			
	users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies					
		ort separately, so the transmit p ne antenna transmission modes				

# A.5.1.7 OCNG FDD pattern 7: dynamic OCNG FDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in

multiple parts by the *M* allocated blocks for data transmission). The *m*-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m} - 1$ , where m = 1, ..., M. The system bandwidth starts with RPB 0 and ends with  $N_{RB} - 1$ .

F						
0						
	Allocation					
$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$				
			PDSCH Data			
$(PRBN_{End,(m-1)}) - (PRB$	$(PRBN_{End,(m-1)}) - (PRB$	$(PRBN_{End,(m-1)}) - (PRB$				
$N_{Start,m} - 1$ )	$N_{Start,m} - 1$ )	$N_{Start,m} - 1$ )				
$(PRBN_{End,M}) - (PRB$	$(PRBN_{End,M}) - (PRB(PRBN_{End,M}) - (PRB$					
$N_{RB} - 1$ )	$N_{RB} - 1$ )	$N_{RB} - 1$ )				
0	0	0	Note 1			
	source blocks are assigned to a mitted over the OCNG PDSCH					
modulated. The pa	rameter $\gamma_{\scriptscriptstyle PRB}$ is used to scale t	he power of PDSCH.				
Note 2: If two or more transmit antennas with CRS are used in the test, the		ed in the test, the OCNG shall I	be transmitted to the virtual			
users by all the tra	users by all the transmit antennas with CRS according to transmission mode 2. T					
	ort separately, so the transmit p ne antenna transmission modes					

#### Table A.5.1.7-1: OP.7 FDD: OCNG FDD Pattern when user data is in multiple non-contiguous blocks

# A.5.1.8 OCNG FDD pattern 8: One sided dynamic OCNG FDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Relative power level $\gamma_{_{PRB}}$ [dB]						
Subframe						
	0 5 1-4,6-9					
		Allocation		Data		
First u	unallocated PRB	First unallocated PRB	First unallocated PRB			
Last u	unallocated PRB	Last unallocated PRB	Last unallocated PRB			
	0	0	0	Note 1,2,3		
Note 1:			arbitrary number of virtual UEs wir PDSCHs shall be uncorrelated ps			
	data, which is 16QAM modulated. The parameter $\gamma_{_{PRB}}$ is used to scale the power of PDSCH.					
Note 2:	transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					
Note 3:	The detailed test se	t-up for TM10 transmission i.e P	MI configuration is specified to ea	ch test case.		

## A.5.2 OCNG Patterns for TDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

 $\gamma_i = PDSCH_i \_ RA / OCNG \_ RA = PDSCH_i \_ RB / OCNG \_ RB,$ 

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

## A.5.2.1 OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

		Relative power	level $\gamma_{\scriptscriptstyle PRB}$ [dB]				
Subframe (only if available for DL)							
0		3, 4, 7, 8, 9         1           5         and 6 (as normal subframe)         and 6 (as spectrum of the subframe)		1 and 6 (as special subframe) <sup>Note 2</sup>	PDSCH Data		
		Allo	cation				
First unallocated PRB		First unallocated PRB –	First unallocated PRB –	First unallocated PRB –			
Last una	llocated PRB	Last unallocated PRB	Last unallocated PRB	Last unallocated PRB			
	0 0 0 0		Note 1				
Note 1:			ssigned to an arbitrary num ne OCNG PDSCHs shall be				
	which is QPS	SK modulated. The param	neter $\gamma_{\scriptscriptstyle PRB}$ is used to scale	the power of PDSCH.			
Note 2:		Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211					
Note 3:	e 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The						
	parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is equal between all the						
	transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.						

#### Table A.5.2.1-1: OP.1 TDD: One sided dynamic OCNG TDD Pattern

## A.5.2.2 OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is

discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{\rm _{RB}}$  –1.

Relative power level $\gamma_{_{PRB}}$ [dB]						
	Subframe (only if available for DL)					
	0	5	3, 4, 6, 7, 8, 9	1,6		
			(6 as normal subframe)	(6 as special subframe)		
		Alloc	ation			
	0 -	0 —	0 —	0 —		
(First all	ocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)		
	and	and	and	and		
(Last allo	cated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –		
( )	$N_{RB} - 1$ )	$(N_{RB} - 1)$	$(N_{RB} - 1)$	$(N_{RB} - 1)$		
0 0		0	0	0	Note 1	
Note 1:				rtual UEs with one PDSCH p oseudo random data, which i		
	modulated. The	parameter $\gamma_{\scriptscriptstyle PRB}$ is used to s	cale the power of PDSCH.			
Note 2:						
Note 3:	If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual					
	users by all the	transmit antennas with CRS	according to transmission m	ode 2. The parameter $\gamma_{_{PRB}}$ a	applies to	
	each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					

# A.5.2.3 OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

			Relative power	level $\gamma_{\scriptscriptstyle PRB}$ [dB]			
Allocation			Subframe				PMCH Data
$n_{PR}$	В	0	5	4, 9 <sup>Note 2</sup>	1, 6		
1 – 49		0	0 (Allocation: all empty PRB-s)	N/A	0	Note 1	N/A
0 - 49		N/A	N/A	0	N/A	N/A	Note 3
Note 2:	Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per vi UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QF modulated. The parameter $\gamma_{PRB}$ is used to scale the power of PDSCH. Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in					which is QPSK	
Note 3: Note 4:	3GPP TS 36.211. Note 3: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.					hall be QPSK	
Note 4.	e 4: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between al the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.						split between all
N/A	Not A	pplicable					

## A.5.2.4 OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

		Relative power level $\gamma_{_{PRB}}$ [dB]				PMCH Data
Allocation		Subframe (	PDSCH Data			
n <sub>PRB</sub>	0 and 6 (as normal subframe)	1 (as special subframe)	5	3, 4, 7 – 9	T Doon Data	T MOTT Data
First unallocate d PRB – Last unallocate d PRB	0	0 (Allocation: all empty PRB-s of DwPTS)	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A
First unallocate d PRB – Last unallocate d PRB	N/A	N/A	N/A	N/A	N/A	Note2
N N	These physical reso virtual UE; the data which is QPSK mod	transmitted over t dulated. The parar	he OCNG PDSCH neter ${\gamma}_{_{PRB}}$ is used	Hs shall be uncorre I to scale the powe	elated pseudo ran er of PDSCH.	dom data,
(	Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.					
t t	If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					
N/A	Not Applicable					

Table A.5.2.4-1: OP.4 TDD: One sided dynamic OCNG TDD Pattern for MBMS transmission

## A.5.2.5 OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]							
Subframe (only if available for DL)							
0		0 5 3, 0 5 and sub		1 and 6 (as special subframe) <sup>Note 2</sup>	PDSCH Data		
		Allo	cation				
First una	llocated PRB	First unallocated PRB –	First unallocated PRB -	First unallocated PRB –			
Last una	located PRB	Last unallocated PRB	Last unallocated PRB	Last unallocated PRB			
	0 0 0 0				Note 1		
Note 1:			ssigned to an arbitrary num he OCNG PDSCHs shall be				
	which is 16Q	AM modulated. The para	meter $\gamma_{\scriptscriptstyle PRB}$ is used to scale	e the power of PDSCH.			
Note 2:		Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211					
Note 3:	Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay						
	CDD). The p	arameter ${\gamma}_{_{PRB}}$ applies to	each antenna port separa	tely, so the transmit powe	er is equal		
		he transmit antennas with section 7.1 in 3GPP TS 36	n CRS used in the test. The 5.213.	e antenna transmission m	odes are		

#### Table A.5.2.5-1: OP.5 TDD: One sided dynamic 16QAM modulated OCNG TDD Pattern

# A.5.2.6 OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{RB} - 1$ .

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					PDSCH Data
Subframe (only if available for DL)					Dala
0		5	3, 4, 6, 7, 8, 9	1,6	
			(6 as normal subframe)	(6 as special subframe)	
		Alloc	ation		
0 – (First	0 – (First allocated PRB 0 – (First allocated PRB 0 – (First allocated PRB 0 – (First allocated PR		0 – (First allocated PRB		
of fir	st block -1)	of first block -1)	of first block -1)	of first block -1)	
	and	and	and	and	
(Last all	ocated PRB of	(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of	
first block +1) – (First		first block +1) – (First	first block +1) – (First	first block +1) – (First	
allocated PRB of second		allocated PRB of second	allocated PRB of second	allocated PRB of second	
block -1)		block -1)	block -1)	block -1)	
0 0		0	0	Note 1	
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK					
modulated. The parameter $\gamma_{_{PRB}}$ is used to scale the power of PDSCH.					
Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211					
Note 3:	If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual				
	users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies to			applies to	
each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.				CRS used	

Table A.5.2.6-1: OP.6 TDD: OCNG TDD Pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the *M* allocated blocks for data transmission). The *m*-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m}$  –1, where m = 1, ..., M. The system bandwidth starts with RPB 0 and ends with  $N_{RB}$  –1.

#### Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]					PDSCH Data
Subframe (only if available for DL)					Dala
0 5			3, 4, 6, 7, 8, 9	1,6	
			(6 as normal subframe)	(6 as special subframe)	
		Alloc	ation		
0 – (PRB	$N_{Start,1}-1$ )	$0 - (PRBN_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	
(PRB N <sub>I</sub>	$E_{nd,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$	$(PRBN_{End,(m-1)})$ –	$(PRBN_{End,(m-1)})$ –	
(PRB N	$V_{Start,m} - 1$ )	(PRB $N_{Start,m} - 1$ )	(PRB $N_{Start,m} - 1$ )	(PRB $N_{Start,m} - 1$ )	
(PRB N <sub>En</sub>	$d_{d,M}$ ) – (PRB	$(PRBN_{End,M}) - (PRB$	$(PRBN_{End,M})$ – $(PRB$	(PRB $N_{End,M}$ ) – (PRB	
$N_{RB} - 1$ )		$N_{RB} - 1$ )	$N_{RB} - 1$ )	$N_{RB} - 1$ )	
	0	0	0	0	Note 1
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter $\gamma_{PRB}$ is used to scale the power of PDSCH.					
Note 2:					
	If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{PRB}$ applies to				
each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					

# A.5.2.8 OCNG TDD pattern 8: One sided dynamic OCNG TDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

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Relative power level $\gamma_{_{PRB}}$ [dB]					
Subframe					
0		5	1 – 4, 6 – 9	PDSCH Data	
	Allocation				
First unallocated PRB		First unallocated PRB	First unallocated PRB		
Last unallocated PRB		Last unallocated PRB	Last unallocated PRB		
0		0	0	Note 1,2,3	
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random					
	data, which is 16QAM modulated. The parameter ${\gamma}_{\scriptscriptstyle PRB}$ is used to scale the power of PDSCH.				
Note 2:	lote 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.				
Note 3:	The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.				

#### Table A.5.1.1-1: OP.8 TDD: One sided dynamic OCNG TDD Pattern

## Annex B (normative): Propagation conditions

## B.1 Static propagation condition

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}.$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j & -j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j & j \\ 1 & 1 & 1 & 1 & -j & -j & -j & -j \end{bmatrix}$$

## B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.

- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency

- A set of correlation matrices defining the correlation between the UE and eNodeB antennas in case of multi-antenna systems.

- Additional multi-path models used for CQI (Channel Quality Indication) tests

## B.2.1 Delay profiles

The delay profiles are selected to be representative of low, medium and high delay spread environments. The resulting model parameters are defined in Table B.2.1-1 and the tapped delay line models are defined in Tables B.2.1-2, B.2.1-3 and B.2.1-4.

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)
Extended Pedestrian A (EPA)	7	45 ns	410 ns
Extended Vehicular A model (EVA)	9	357 ns	2510 ns
Extended Typical Urban model (ETU)	9	991 ns	5000 ns

Table B.2.1-1 Delay profiles for E-UTRA channel models

#### Table B.2.1-2 Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

#### Table B.2.1-3 Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table B.2.1-4 Extended Typical Urban model (ETL
-------------------------------------------------

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

## B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as EVA[number], EPA[number] or ETU[number] where 'number' indicates the maximum Doppler frequency (Hz).

#### Table B.2.2-1 Void

## **B.2.3 MIMO Channel Correlation Matrices**

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both eNodeB and UE.

### B.2.3.1 Definition of MIMO Correlation Matrices

Table B.2.3.1-1 defines the correlation matrix for the eNodeB

	One antenna	Two antennas	Four antennas
eNode B Correlation	$R_{eNB} = 1$	$R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$	$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^* & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$

Table B.2.3.1-2 defines the correlation matrix for the UE:

Table B.2.3.1-1 eNodeB correlation matrix

	One antenna	Two antennas	Four antennas
UE Correlation	<i>R<sub>UE</sub></i> = 1	$R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$	$R_{UE} = \begin{pmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{*} & \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 \end{pmatrix}$

Table B.2.3.1-3 defines the channel spatial correlation matrix  $R_{spat}$ . The parameters,  $\alpha$  and  $\beta$  in Table B.2.3.1-3 defines the spatial correlation between the antennas at the eNodeB and UE.

1x2 case	$R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$	
2x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$	
4x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^{*} & 1 \end{bmatrix}$	
4x4 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{*} & \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 \end{bmatrix}$	

#### Table B.2.3.1-3: $R_{spat}$ correlation matrices

For cases with more antennas at either eNodeB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of  $R_{eNB}$  and  $R_{UE}$  according to  $R_{spat} = R_{eNB} \otimes R_{UE}$ .

#### B.2.3.2 MIMO Correlation Matrices at High, Medium and Low Level

The  $\alpha$  and  $\beta$  for different correlation types are given in Table B.2.3.2-1.

Tab	le	Β.	2.	3.	2-	1

Low cor	relation	Medium C	orrelation	High Correlation				
α	β	α	β	α	β			
0	0	0.3	0.9	0.9	0.9			

The correlation matrices for high, medium and low correlation are defined in Table B.2.3.1-2, B.2.3.2-3 and B.2.3.2-4, as below.

The values in Table B.2.3.2-2 have been adjusted for the 4x2 and 4x4 high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spatial} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the  $4x^2$  high correlation case, a=0.00010. For the  $4x^4$  high correlation case, a=0.00012.

The same method is used to adjust the 4x4 medium correlation matrix in Table B.2.3.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00012.

1x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$								
2x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$								
4x2 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9542 & 0.8894 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9542 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8894 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$								
4x4 case	$R_{\rm high} = \begin{bmatrix} 1.0000\ 0.9882\ 0.9541\ 0.8999\ 0.9882\ 0.9767\ 0.9430\ 0.8894\ 0.9541\ 0.9430\ 0.9105\ 0.8587\ 0.8999\ 0.8894\ 0.8587\ 0.8099\\ 0.9882\ 1.0000\ 0.9882\ 0.9541\ 0.9767\ 0.9882\ 0.9767\ 0.9430\ 0.9430\ 0.9541\ 0.9430\ 0.9105\ 0.8587\ 0.8999\ 0.8894\ 0.8587\\ 0.9541\ 0.9882\ 1.0000\ 0.9882\ 0.9430\ 0.9767\ 0.9882\ 0.9767\ 0.9105\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.8587\ 0.8894\ 0.8999\ 0.8894\\ 0.8999\ 0.9541\ 0.9882\ 1.0000\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9105\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.982\ 0.9541\ 0.982\ 0.9541\ 0.982\ 0.9541\ 0.982\ 0.9541\ 0.9822\ 0.9767\ 0.9882\ 0.9541\ 0.9882\ 0.9767\ 0.9882\ 0.9541\ 0.9882\ 0.9767\ 0.9882\ 0.9541\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9882\ 0$								

Table B.2.3.2-2: MIMO correlation matrices for high correlation

1x2 case									N/A								
2x2 case		$R_{medium} = \begin{pmatrix} 1 & 0.9 & 0.3 & 0.27 \\ 0.9 & 1 & 0.27 & 0.3 \\ 0.3 & 0.27 & 1 & 0.9 \\ 0.27 & 0.3 & 0.9 & 1 \end{pmatrix}$															
4x2 case		R <sub>med</sub>	<sub>lium</sub> =	0. 0. 0. 0. 0. 0.	0000 9000 8748 7873 5856 5271 3000 2700	0.900 1.000 0.787 0.874 0.527 0.585 0.270 0.300	00       0.         73       1.         18       0.         71       0.         56       0.         00       0.	8748 7873 0000 9000 8748 7873 5856 5271	0.787 0.874 0.900 1.000 0.787 0.874 0.527 0.585	8       0.         0       0.         0       0.         3       1.         8       0.         1       0.	5271 8748 7873 0000 9000 .8748	0.527 0.5856 0.7873 0.8748 0.9000 1.0000 0.7873 0.8748	5 0.2 3 0.5 8 0.5 0 0.8 0 0.7 3 1.0	700 856 271 748 873 000	0.2700 0.3000 0.5271 0.5856 0.7873 0.8748 0.9000 1.0000		
4x4 case	R <sub>medium</sub> =	(1.0000         0.           0.9882         1.           0.9541         0.           0.8799         0.           0.8747         0.           0.8645         0.           0.8347         0.           0.7872         0.           0.5855         0.           0.5787         0.           0.5270         0.           0.3000         0.           0.2862         0.           0.2700         0.	.0000 .9882 .9541 .8645 .8747 .8645 .8347 .5787 .5855 .5787 .5588 .2965 .3000 .2965	0.9882 1.0000 0.9882 0.8347 0.8645 0.8747 0.8645 0.5588 0.5787 0.5855 0.5787 0.2862 0.2965 0.3000	0.9541 0.9882 1.0000 0.7872 0.8347 0.8645 0.8747 0.5270 0.5588 0.5787 0.5855 0.2700 0.2862 0.2965	0.8645 0.8347 0.7872 1.0000 0.9882 0.9541 0.8999 0.8747 0.8645 0.8347 0.7872 0.5855 0.5787 0.5588	0.8747 0.8645 0.8347 0.9882 1.0000 0.9882 0.9541 0.8645 0.8747 0.8645 0.8347 0.5787 0.5855 0.5787	0.8645 0.8747 0.8645 0.9541 0.9882 1.0000 0.9882 0.8347 0.8645 0.8747 0.8645 0.5588 0.5787 0.5855	0.8347 0.8645 0.8747 0.8999 0.9541 0.9882 1.0000 0.7872 0.8347 0.8645 0.8747 0.5270 0.5588 0.5787	0.5787 0.5588 0.5270 0.8747 0.8645 0.8347 0.7872 1.0000 0.9882 0.9541 0.8999 0.8747 0.8645 0.8347	<ul> <li>3 0.5787</li> <li>) 0.5588</li> <li>7 0.8645</li> <li>5 0.8747</li> <li>7 0.8645</li> <li>2 0.8347</li> <li>) 0.9882</li> <li>2 1.0000</li> <li>1 0.9882</li> <li>2 0.9541</li> <li>7 0.8645</li> <li>5 0.8747</li> <li>7 0.8645</li> </ul>	0.5787 0.5855 0.5787 0.8347 0.8645 0.8747 0.8645 0.9541 0.9882 1.0000 0.9882 0.8347 0.8645 0.8747	0.5588 0.5787 0.5855 0.7872 0.8347 0.8645 0.8747 0.8999 0.9541 0.9882 1.0000 0.7872 0.8347 0.8645	0.2965 0.2862 0.2700 0.5855 0.5787 0.5588 0.5270 0.8747 0.8645 0.8347 0.7872 1.0000 0.9882 0.9541	0.3000 0.2965 0.2862 0.5787 0.5558 0.5787 0.5588 0.8645 0.8747 0.8645 0.8347 0.9882 1.0000 0.9882	0.2965 0.3000 0.2965 0.5588 0.5787 0.5855 0.5787 0.8347 0.8645 0.8747 0.8645 0.9541 0.9882 1.0000	0.2862 0.2965 0.3000 0.5270 0.5588 0.5787 0.5855 0.7872 0.8347 0.8645 0.8747 0.8999 0.9541 0.9882

Table B.2.3.2-4: MIMO correlation matrices for low correlation

1x2 case	$R_{low} = \mathbf{I}_2$
2x2 case	$R_{low} = \mathbf{I}_4$
4x2 case	$R_{low} = \mathbf{I}_8$
4x4 case	$R_{low} = \mathbf{I}_{16}$

In Table B.2.3.2-4,  $\mathbf{I}_d$  is the  $d \times d$  identity matrix.

# B.2.3A MIMO Channel Correlation Matrices using cross polarized antennas

The MIMO channel correlation matrices defined in B.2.3A apply for the antenna configuration using cross polarized antennas at both eNodeB and UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

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For the cross-polarized antennas, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of transmit or receive antennas.

#### B.2.3A.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- $R_{UE}$  is the spatial correlation matrix at the UE with same polarization,
- $R_{eNB}$  is the spatial correlation matrix at the eNB with same polarization,
- $\Gamma$  is a polarization correlation matrix, and
- $(\bullet)^T$  denotes transpose.

The matrix  $\Gamma$  is defined as

$$\Gamma = \begin{bmatrix} 1 & 0 & -\gamma & 0 \\ 0 & 1 & 0 & \gamma \\ -\gamma & 0 & 1 & 0 \\ 0 & \gamma & 0 & 1 \end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & for \ a = (j-1)Nr + i \ and \ b = 2(j-1)Nr + i, \\ 1 & for \ a = (j-1)Nr + i \ and \ b = 2(j-Nt/2)Nr - Nr + i, \\ 0 & otherwise \end{cases} i = 1, \dots, Nr, \ j = Nt/2 + 1, \dots, Nt + i \\ 0 & otherwise \end{cases}$$

where  $N_t$  and  $N_r$  is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3A.

## B.2.3A.2 Spatial Correlation Matrices using cross polarized antennas at eNB and UE sides

#### B.2.3A.2.1 Spatial Correlation Matrices at eNB side

For 2-antenna transmitter using one pair of cross-polarized antenna elements,  $R_{eNB} = 1$ .

For 4-antenna transmitter using two pairs of cross-polarized antenna elements,  $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$ .

For 8-antenna transmitter using four pairs of cross-polarized antenna elements, 
$$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$$

#### B.2.3A.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements,  $R_{UE} = 1$ .

For 4-antenna receiver using two pairs of cross-polarized antenna elements,  $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ .

## B.2.3A.3 MIMO Correlation Matrices using cross polarized antennas

The values for parameters  $\alpha$ ,  $\beta$  and  $\gamma$  for high spatial correlation are given in Table B.2.3A.3-1.

 abi	е в	.2.3	A.3	-1

	High spatial correlation	
0.9	0.9	0.3
Note 1: Value of $\alpha$ applies when r	nore than one pair of cross-polarized ar	tenna elements at eNB side.
Note 2: Value of $\beta$ applies when r	nore than one pair of cross-polarized ar	tenna elements at UE side.

The correlation matrices for high spatial correlation are defined in Table B.2.3A.3-2 as below.

The values in Table B.2.3A.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after roundoff to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8x2 high spatial correlation case, a=0.00010.

Table B.2.3A.3-2: MIMO correla	ation matrices for h	igh spatial correlation

		1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000
		0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700
		0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000
		0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862
		0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000
		0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965
		0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	-0.2700	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000
	D	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000
8x2 case	$R_{high} =$	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000
		0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999
		-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000
		0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542
		-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000
		0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000	0.9883
		-0.2700	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000	0.0000
		0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000

#### B.2.3A.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3A.1, the corresponding random channel matrix H can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_k}Wx + n$$

Where

- H is the Nr xNt channel matrix per subcarrier.

- 
$$D_{\theta_k}$$
 is the steering matrix, which is  $D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_k} & 0 & 0 \\ 0 & 0 & e^{j2\theta_k} & 0 \\ 0 & 0 & 0 & e^{j3\theta_k} \end{bmatrix}$ 

-  $\theta_k$  controls the phase variation, and the phase for k-th subframe is denoted by  $\theta_k = \theta_0 + \Delta \theta \cdot k$ , where  $\theta_0$  is the random start value with the uniform distribution, i.e.,  $\theta_0 \in [0, 2\pi]$ ,  $\Delta \theta$  is the step of phase variation, which is defined in Table B.2.3A.4-1, and *k* is the linear increment of 1 for every subframe throughout the simulation,

- W is the precoding matrix for 8 transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3A.4-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta  heta$	1.2566×10⁻³

## B.2.4 Propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(-i2\pi f_D t) \delta(\tau - \tau_d),$$

in continuous time  $(t, \tau)$  representation, with  $\tau_d$  the delay, *a* a constant and  $f_D$  the Doppler frequency. The same  $h(t,\tau)$  is used to describe the fading channel between every pair of Tx and Rx.

#### B.2.4.1 Propagation conditions for CQI tests with multiple CSI processes

For CQI tests with multiple CSI processes, the following additional multi-path profile is used for 2 port transmission:

$$H = \begin{bmatrix} 1 & j \\ 1 & -j \end{bmatrix} \circ H_{MP}$$

Where  $\circ$  represents Hadamard product,  $H_{MP}$  indicates the 2x2 propagation channel generated in the manner defined in Clause B.2.4.

## B.2.5 Void

## **B.2.6 MBSFN Propagation Channel Profile**

Table B.2.6-1 shows propagation conditions that are used for the MBSFN performance requirements in multi-path fading environment in an extended delay spread environment.

Table B.2.6-1: Propagation Conditions for Multi-Path Fading Environments for MBSFN Performance
Requirements in an extended delay spread environment

Extended Delay Spread			
Maximum Doppler frequency [5Hz]			
Relative Delay [ns]	Relative Mean Power [dB]		
0	0		
30	-1.5		
150	-1.4		
310	-3.6		
370	-0.6		
1090	-7.0		
12490	-10		
12520	-11.5		
12640	-11.4		
12800	-13.6		
12860	-10.6		
13580	-17.0		
27490	-20		
27520	-21.5		
27640	-21.4		
27800	-23.6		
27860	-20.6		
28580	-27.0		

## B.3 High speed train scenario

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1}$$

where  $f_s(t)$  is the Doppler shift and  $f_d$  is the maximum Doppler frequency. The cosine of angle  $\theta(t)$  is given by

$$\cos\theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.2)

$$\cos\theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.3)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), t > 2D_s/v \tag{B.3.4}$$

where  $D_s/2$  is the initial distance of the train from eNodeB, and  $D_{\min}$  is eNodeB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

Doppler shift and cosine angle are given by equation B.3.1 and B.3.2-B.3.4 respectively, where the required input parameters listed in table B.3-1 and the resulting Doppler shift shown in Figure B.3-1 are applied for all frequency bands.

Parameter	Value
$D_s$	300 m
$D_{\min}$	2 m
ν	300 km/h
$f_d$	750 Hz

Table B.3-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3-1 including  $f_d$  and Doppler shift trajectories presented on figure B.3-1 were derived from Band 7 and are applied for performance verification in all frequency bands.

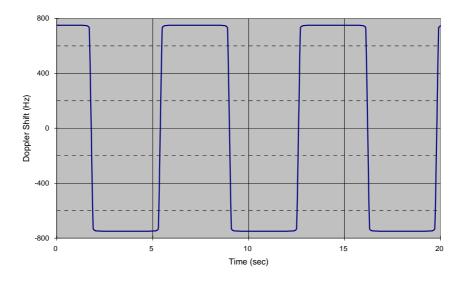


Figure B.3-1: Doppler shift trajectory

For 1x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx.

For 2x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx with phase shift according to  $\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}$ .

## B.4 Beamforming Model

## B.4.1 Single-layer random beamforming (Antenna port 5, 7, or 8)

Single-layer transmission on antenna port 5 or on antenna port 7 or 8 without a simultaneous transmission on the other antenna port, is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{\text{symb}}^{\text{ap}} -1$ , for antenna port  $p \in \{5, 7, 8\}$ , with  $M_{\text{symb}}^{\text{ap}}$  the number of modulation symbols including the

user-specific reference symbols (DRS), and generates a block of signals  $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \tilde{y}_{bf}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i)$$

Single-layer transmission on antenna port 7 or 8 with a simultaneous transmission on the other antenna port, is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size 2×1, which are not identical and randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} \left( W_1(i) y^{(7)}(i) + W_2(i) y^{(8)}(i) \right)$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\tilde{y}_{bf}(i)$ .

## B.4.2 Dual-layer random beamforming (antenna ports 7 and 8)

Dual-layer transmission on antenna ports 7 and 8 is defined by using a precoder matrix W(i) of size 2×2 randomly selected with the number of layers v = 2 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input a block of signals for antenna ports 7 and 8,  $y(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) \end{bmatrix}^T$ ,  $i = 0,1,...,M_{symb}^{ap} - 1$ , with  $M_{symb}^{ap}$  being the number of modulation symbols per antenna port including the user-specific reference symbols, and generates a block of signals  $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \tilde{y}_{bf}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix},$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\tilde{y}_{bf}(i)$ .

## B.4.3 Generic beamforming model (antenna ports 7-14)

The transmission on antenna port(s) p = 7,8,...,v + 6 is defined by using a precoder matrix W(i) of size  $N_{CSI} \times v$ , where  $N_{CSI}$  is the number of CSI reference signals configured per test and v is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) p = 7,8,...,v + 6,  $y^{(p)}(i) = \left[y^{(7)}(i) \quad y^{(8)}(i) \quad \cdots \quad y^{(6+v)}(i)\right], i = 0,1,...,M_{symb}^{ap} - 1$ , with  $M_{symb}^{ap}$  being the number of modulation symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals  $y_{bf}^{(q)}(i) = \left[y_{bf}^{(0)}(i) \quad y_{bf}^{(1)}(i) \quad \ldots \quad y_{bf}^{(N_{CSI}-1)}(i)\right]^{T}$  the elements of which are to be mapped onto the same time-frequency index pair (k, l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

The precoder matrix W(i) is specific to a test case.

The physical antenna elements are identified by indices  $j = 0, 1, ..., N_{ANT} - 1$ , where  $N_{ANT} = N_{CSI}$  is the number of physical antenna elements configured per test.

Modulation symbols  $y_{bf}^{(q)}(i)$  with  $q \in \{0,1,...,N_{CSI}-1\}$  (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j = q.

Modulation symbols  $y^{(p)}(i)$  with  $p \in \{0,1,..., P-1\}$  (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j = p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{0,1,..., P-1\}$  (i.e. CRS) are mapped to the physical antenna index j = p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{15, 16, ..., 14 + N_{CSI}\}$  (i.e. CSI-RS) are mapped to the physical antenna index j = p - 15, where  $N_{CSI}$  is the number of CSI reference signals configured per test.

# B.4.4 Random beamforming for EPDCCH distributed transmission (Antenna port 107 and 109)

EPDCCH distributed transmission on antenna port 107 and antenna port 109 is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size 2×1, which are not identical and randomly selected per EPDCCH PRB pair with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4], as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{symb}^{ap} - 1$ , for antenna port  $p \in \{107, 109\}$ , with  $M_{symb}^{ap}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a block of signals  $y_{bf}(i) = [y_{bf}(i) \ \tilde{y}_{bf}(i)]^{t}$ . When EPDCCH is associated with port 107, the transmitted block of signals is deonted as

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W_1(i) y^{(107)}(i).$$

When EPDCCH is associated with port 109, the transmitted block of signals is denoted as

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W_2(i) y^{(109)}(i).$$

# B.4.5 Random beamforming for EPDCCH localized transmission (Antenna port 107, 108, 109 or 110)

EPDCCH localized transmission on antenna port 107, 108, 109 or 110 is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{symb}^{ap} - 1$ , for antenna port  $p \in \{107, 108, 109, 110\}$ , with  $M_{symb}^{ap}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a

block of signals  $y_{bf}(i) = [y_{bf}(i) \ \tilde{y}_{bf}(i)]^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\left| \begin{array}{c} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{array} \right| = W(i) y^{(p)}(i) \, .$$

# B.5 Interference models for enhanced performance requirements Type-A

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-A including: definition of dominant interferer proportion, transmission mode 3, 4 and 9 type of interference modelling.

## B.5.1 Dominant interferer proportion

Each interfering cell involved in enhanced performance requirements Type-A is characterized by its associated dominant interferer proportion (DIP) value:

$$DIP_i = \frac{\hat{I}_{or(i+1)}}{N_{oc}}$$

where is  $\hat{I}_{or(i+1)}$  is the average received power spectral density from the i-th strongest interfering cell involved in the requirement scenario ( $\hat{I}_{or(1)}$  is assumed to be the power spectral density associated with the serving cell) and

 $N_{oc}' = \sum_{i=2}^{N} \hat{I}_{or(j)} + N_{oc}$  where  $N_{oc}$  is the average power spectral density of a white noise source consistent with the

definition provided in subclause 3.2 and N is the total number of cells involved in a given requirement scenario.

## B.5.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For rank-1 transmission over a subband, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission over a subband, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## B.5.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices for each subframe and each CQI subband.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## B.5.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and each CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-2 of [4].

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe and each CQI subband shall be applied to 16QAM randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## Annex C (normative): Downlink Physical Channels

## C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

## C.2 Set-up

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Physical Channel
PBCH
SSS
PSS
PCFICH
PDCCH
EPDCCH
PHICH
PDSCH

## Table C.2-1: Downlink Physical Channels required for connection set-up

## C.3 Connection

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

## C.3.1 Measurement of Receiver Characteristics

Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7).

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio
PBCH	$PBCH_RA = 0 dB$
	PBCH_RB = 0 dB
PSS	$PSS_RA = 0 dB$
SSS	$SSS_RA = 0 dB$
PCFICH	$PCFICH_RB = 0 dB$
PDCCH	$PDCCH_RA = 0 dB$
	$PDCCH_RB = 0 dB$
PDSCH	$PDSCH_RA = 0 dB$
	$PDSCH_RB = 0 dB$
OCNG	$OCNG_RA = 0 dB$
	$OCNG_RB = 0 dB$

NOTE 1: No boosting is applied.

Parameter	Unit	Value	Note
Transmitted power spectral density $I_{or}$	dBm/15 kHz	Test specific	1. $I_{or}$ shall be kept constant throughout all OFDM symbols
Cell-specific reference signal power ratio $E_{RS} / I_{ar}$		0 dB	
Signal power ratio $E_{RS} / I_{or}$			

Table C.3.1-2: Power allocation for OFDM symbols and reference signals

## C.3.2 Measurement of Performance requirements

Table C.3.2-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels.

Table C.3.2-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio
PBCH	$PBCH_RA = \rho_A + \sigma$
	$PBCH_RB = \rho_B + \sigma$
PSS	$PSS_RA = 0$ (Note 3)
SSS	$SSS_RA = 0$ (Note 3)
PCFICH	PCFICH_RB = $\rho_B$ + $\sigma$
PDCCH	PDCCH_RA = $\rho_A$ + $\sigma$
	PDCCH_RB = $\rho_B$ + $\sigma$
EPDCCH	EPDCCH_RA = $\rho_A + \delta$
	EPDCCH_RB = $\rho_B + \delta$
PDSCH	PDSCH_RA = $\rho_A$
	PDSCH_RB = $\rho_B$
PMCH	PMCH_RA = $\rho_A$
	PMCH_RB = $\rho_B$
MBSFN RS	MBSFN RS_RA = $\rho_A$
	MBSFN RS_RB = $\rho_B$
OCNG	OCNG_RA = $\rho_A$ + $\sigma$
	OCNG_RB = $\rho_B$ + $\sigma$

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: MBSFN RS and OCNG are not defined downlink physical channels in [4].

NOTE 3: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 4:  $\rho_A$ ,  $\rho_B$ ,  $\sigma$  and  $\delta$  are test specific.

NOTE 5: For TM 8, TM 9 and TM10  $\rho_A$ ,  $\rho_B$  are used for the purpose of the test set up only.

Parameter	Unit	Value	Note
Total transmitted power	dBm/15 kHz	Test specific	1. $I_{ar}$ shall be kept
spectral density $I_{or}$			constant throughout all OFDM symbols
Cell-specific reference		Test specific	1. Applies for antenna
signal power ratio $E_{\rm RS}$ / $I_{\it or}$			port p
Energy per resource element EPRE		Test specific	1. The complex-valued symbols $y^{(p)}(i)$ and
			$a_{k,l}^{(p)}$ defined in [4] shall
			conform to the given EPRE value. 2. For TM8, TM9, and TM10 the reference point for EPRE is before the precoder in Annex B.4.

Table C.3.2-2: Power allocation for OFDM symbols and reference signals

## C.3.3 Aggressor cell power allocation for Measurement of Performance Requirements when ABS is Configured

For the performance requirements and channel state information reporting when ABS is configured, the power allocation for the physical channels of the aggressor cell in non-ABS and ABS is listed in Table C.3.3-1.

## Table C.3.3-1: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell

Physical Channel	Parameters	Unit	EPRE Ratio	
Physical Channel			Non-ABS	ABS
PBCH	PBCH_RA	dB	ρ <sub>Α</sub>	Note 1
PBCH	PBCH_RB	dB	ρ <sub>Β</sub>	Note 1
PSS	PSS_RA	dB	ρΑ	Note 1
SSS	SSS_RA	dB	ρΑ	Note 1
PCFICH	PCFICH_RB	dB	ρ <sub>Β</sub>	Note 1
BUILOUL	PHICH_RA	dB	ρ <sub>Α</sub>	Note 1
PHICH	PHICH_RB	dB	ρ <sub>Β</sub>	Note 1
PDCCH	PDCCH_RA	dB	ρΑ	Note 1
PDCCH	PDCCH_RB	dB	ρ <sub>Β</sub>	Note 1
PDSCH	PDSCH_RA	dB	N/A	Note 1
	PDSCH_RB	dB	N/A	Note 1
OCNG	OCNG_RA	dB	ρΑ	Note 1
UCING	OCNG_RB	dB	ρ <sub>Β</sub>	Note 1

Dhysical Channel	Parameters	Unit	EPRE Ratio	
Physical Channel		Unit	Non-ABS	ABS
PBCH	PBCH_RA	dB	ρΑ	ρΑ
FBCH	PBCH_RB	dB	ρ <sub>B</sub>	ρ <sub>B</sub>
PSS	PSS_RA	dB	ρΑ	ρΑ
SSS	SSS_RA	dB	ρΑ	ρΑ
PCFICH	PCFICH_RB	dB	ρ <sub>в</sub>	Note 1
DUIGU	PHICH_RA	dB	ρΑ	Note 1
PHICH	PHICH_RB	dB	ρ <sub>B</sub>	Note 1
PDCCH	PDCCH_RA	dB	ρΑ	Note 1
FDCCH	PDCCH_RB	dB	ρ <sub>B</sub>	Note 1
PDSCH	PDSCH_RA	dB	N/A	Note 1
	PDSCH_RB	dB	N/A	Note 1
OCNG	OCNG_RA	dB	ρΑ	Note 1
	OCNG_RB	dB	ρ <sub>в</sub>	Note 1
Note 1: -∞ dB is allocated	for this channel in this test			

Table C.3.3-2: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell when the CRS assistance information is provided

## C.3.4 Power Allocation for Measurement of Performance Requirements when Quasi Co-location Type B: same Cell ID

For the performance requirements related to quasi-colocation type B behaviour when transmission points share the same Cell ID, the power allocation for the physical channels of the serving cell is listed in table C.3.4-1 and the power allocation for the physical channels of the cell transmitting PDSCH is listed in table C.3-4-2

Physical Channel	EPRE Ratio
PBCH	PBCH_RA = $\rho_A$ + $\sigma$
	PBCH_RB = $\rho_B$ + $\sigma$
PSS	$PSS_RA = 0$ (Note 2)
SSS	$SSS_RA = 0$ (Note 2)
PDSCH	PDSCH_RA = $\rho_A$
	PDSCH_RB = $\rho_B$
PCFICH	PCFICH_RB = $\rho_B$ + $\sigma$
PDCCH	PDCCH_RA = $\rho_A$ + $\sigma$
	PDCCH_RB = $\rho_B + \sigma$

Table C.3.4-1: Downlink physical channels transmitted in the serving cell (TP1)

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 3:  $\rho_A$ ,  $\rho_B$  and  $\sigma$  are test specific.

#### Table C.3.4-2: Downlink physical channels for the transmission point transmitting PDSCH (TP2)

Physical Channel	Value
PDSCH	Test Specific

## Annex D (normative): Characteristics of the interfering signal

## D.1 General

When the channel band width is wider or equal to 5MHz, a modulated 5MHz full band width E-UTRA down link signal and CW signal are used as interfering signals when RF performance requirements for E-UTRA UE receiver are defined. For channel band widths below 5MHz, the band width of modulated interferer should be equal to band width of the received signal.

## D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel band width options.

	Channel bandwidth							
	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz							
<b>BW</b> Interferer	1.4 MHz	3 MHz	5 MHz	5 MHz	5 MHz	5 MHz		
RB	6	15	25	25	25	25		

## Annex E (normative): Environmental conditions

## E.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

## E.2 Environmental

The requirements in this clause apply to all types of UE(s).

### E.2.1 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table E.2.1-1

+15°C to +35°C	for normal conditions (with relative humidity of 25 % to 75 %)
-10 <sup>°</sup> C to +55 <sup>°</sup> C	for extreme conditions (see IEC publications 68-2-1 and 68-2-2)

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation.

## E.2.2 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The manufacturer shall declare the lower and higher extreme voltages and the approximate shutdown voltage. For the equipment that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified below.

Table	E.2.2-1
-------	---------

Power source	Lower extreme voltage	Higher extreme voltage	Normal conditions voltage
AC mains	0,9 * nominal	1,1 * nominal	nominal
Regulated lead acid battery	0,9 * nominal	1,3 * nominal	1,1 * nominal
Non regulated batteries:			
Leclanché	0,85 * nominal	Nominal	Nominal
Lithium	0,95 * nominal	1,1 * Nominal	1,1 * Nominal
Mercury/nickel & cadmium	0,90 * nominal		Nominal

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

## E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

Frequency	ASD (Acceleration Spectral Density) random vibration
5 Hz to 20 Hz	0,96 m <sup>2</sup> /s <sup>3</sup>
20 Hz to 500 Hz	0,96 m <sup>2</sup> /s <sup>3</sup> at 20 Hz, thereafter –3 dB/Octave

### Table E.2.3-1

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 36.101 for extreme operation.

## Annex F (normative): Transmit modulation

## F.1 Measurement Point

Figure F.1-1 shows the measurement point for the unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).

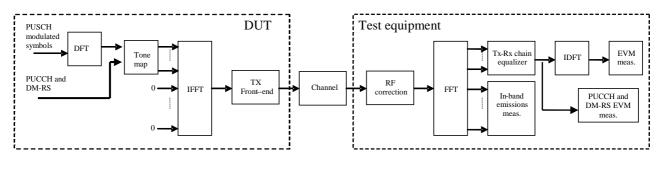


Figure F.1-1: EVM measurement points

## F.2 Basic Error Vector Magnitude measurement

The EVM is the difference between the ideal waveform and the measured waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{v \in T_m} |z'(v) - i(v)|^2}{|T_m| \cdot P_0}}$$

where

 $T_m$  is a set of  $|T_m|$  modulation symbols with the considered modulation scheme being active within the measurement period,

z'(v) are the samples of the signal evaluated for the EVM,

i(v) is the ideal signal reconstructed by the measurement equipment, and

 $P_0$  is the average power of the ideal signal. For normalized modulation symbols  $P_0$  is equal to 1.

The basic EVM measurement interval is defined over one slot in the time domain for PUCCH and PUSCH and over one preamble sequence for the PRACH.

## F.3 Basic in-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks. The in-band emission requirement is evaluated for PUCCH and PUSCH transmissions. The in-band emission requirement is not evaluated for PRACH transmissions.

The in-band emissions are measured as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_s|} \sum_{t \in T_s} \sum_{\substack{max(f_{\min}, f_l + 12 \cdot \Delta_{RB} + \Delta f) \\ min(f_{\max}, f_l + 12 \cdot \Delta_{RB} + \Delta f) \\ min(f_{\max}, f_h + 12 \cdot \Delta_{RB} + \Delta f) \\ \frac{1}{|T_s|} \sum_{t \in T_s} \sum_{\substack{f_h + (12 \cdot \Delta_{RB} - 11) + \Delta f \\ f_h + (12 \cdot \Delta_{RB} - 11) + \Delta f}} |Y(t, f)|^2, \Delta_{RB} > 0 \end{cases}$$

where

 $T_s$  is a set of  $|T_s|$  SC-FDMA symbols with the considered modulation scheme being active within the measurement period,

 $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.  $\Delta_{RB} = 1$  or  $\Delta_{RB} = -1$  for the first adjacent RB),

 $f_{\min}$  (resp.  $f_{\max}$ ) is the lower (resp. upper) edge of the UL system BW,

 $f_l\,\,{\rm and}\,\,f_h\,\,{\rm are}$  the lower and upper edge of the allocated BW, and

Y(t, f) is the frequency domain signal evaluated for in-band emissions as defined in the subsection (ii)

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_s| \cdot N_{RB}} \sum_{t \in T_s} \sum_{f_l}^{f_l + (12 \cdot N_{RB} - 1)\Delta f} |Y(t, f)|^2}$$

where

 $N_{RB}$  is the number of allocated RBs

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

In the evaluation of in-band emissions, the timing is set according to  $\Delta \tilde{t} = \Delta \tilde{c}$ , where sample time offsets  $\Delta \tilde{t}$  and  $\Delta \tilde{c}$  are defined in subclause F.4.

## F.4 Modified signal under test

Implicit in the definition of EVM is an assumption that the receiver is able to compensate a number of transmitter impairments.

The PUSCH data or PRACH signal under test is modified and, in the case of PUSCH data signal, decoded according to::

$$Z'(t,f) = IDFT\left\{\frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{f}v}\right\}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}}\right\}$$

where

z(v) is the time domain samples of the signal under test.

The PUCCH or PUSCH demodulation reference signal or PUCCH data signal under test is equalised and, in the case of PUCCH data signal decoded according to:

$$Z'(t,f) = \frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{f}v}\right\}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}} e^{j2\pi j\Delta \tilde{t}}$$

where

z(v) is the time domain samples of the signal under test.

To minimize the error, the signal under test should be modified with respect to a set of parameters following the procedure explained below.

Notation:

 $\Delta \tilde{t}$  is the sample timing difference between the FFT processing window in relation to nominal timing of the ideal signal.

 $\Delta \tilde{f}$  is the RF frequency offset.

 $\tilde{\varphi}(t, f)$  is the phase response of the TX chain.

 $\tilde{a}(t, f)$  is the amplitude response of the TX chain.

In the following  $\Delta \tilde{c}$  represents the middle sample of the EVM window of length W (defined in the next subsections) or the last sample of the first window half if W is even.

The EVM analyser shall

- > detect the start of each slot and estimate  $\Delta \tilde{t}$  and  $\Delta \tilde{f}$ ,
- > determine  $\Delta \tilde{c}$  so that the EVM window of length W is centred
  - on the time interval determined by the measured cyclic prefix minus 16 samples of the considered OFDM symbol for symbol 0 for normal CP, i.e. the first 16 samples of the CP should not be taken into account for this step. In the determination of the number of excluded samples, a sampling rate of 30.72MHz was assumed. If a different sampling rate is used, the number of excluded samples is scaled linearly.
  - on the measured cyclic prefix of the considered OFDM symbol symbol for symbol 1 to 6 for normal CP and for symbol 0 to 5 for extended CP.
  - on the measured preamble cyclic prefix for the PRACH

To determine the other parameters a sample timing offset equal to  $\Delta \tilde{c}$  is corrected from the signal under test. The EVM analyser shall then

> correct the RF frequency offset  $\Delta \tilde{f}$  for each time slot, and

> apply an FFT of appropriate size. The chosen FFT size shall ensure that in the case of an ideal signal under test, there is no measured inter-subcarrier interference.

The carrier leakage shall be removed from the evaluated signal before calculating the EVM and the in-band emissions; however, the removed relative carrier leakage power also has to satisfy the applicable requirement.

At this stage the allocated RBs shall be separated from the non-allocated RBs. In the case of PUCCH and PUSCH EVM, the signal on the non-allocated RB(s), Y(t, f), is used to evaluate the in-band emissions.

Moreover, the following procedure applies only to the signal on the allocated RB(s).

- In the case of PUCCH and PUSCH, the UL EVM analyzer shall estimate the TX chain equalizer coefficients  $\tilde{a}(t, f)$  and  $\tilde{\varphi}(t, f)$  used by the ZF equalizer for all subcarriers by time averaging at each signal subcarrier of the amplitude and phase of the reference and data symbols. The time-averaging length is 1 slot. This process creates an average amplitude and phase for each signal subcarrier used by the ZF equalizer. The knowledge of data modulation symbols may be required in this step because the determination of symbols by demodulation is not reliable before signal equalization.
- In the case of PRACH, the UL EVM analyzer shall estimate the TX chain coefficients  $\tilde{a}(t)$  and  $\tilde{\varphi}(t)$ used for phase and amplitude correction and are seleted so as to minimize the resulting EVM. The TX chain coefficients are not dependent on frequency, i.e.  $\tilde{a}(t, f) = \tilde{a}(t)$  and  $\tilde{\varphi}(t, f) = \tilde{\varphi}(t)$ . The TX chain coefficient are chosen independently for each preamble transmission and for each  $\Delta \widetilde{t}$  .

At this stage estimates of  $\Delta \tilde{f}$ ,  $\tilde{a}(t, f)$ ,  $\tilde{\varphi}(t, f)$  and  $\Delta \tilde{c}$  are available.  $\Delta \tilde{t}$  is one of the extremities of the window W, i.e.  $\Delta \tilde{t}$  can be  $\Delta \tilde{c} + \alpha - \left| \frac{W}{2} \right|$  or  $\Delta \tilde{c} + \left| \frac{W}{2} \right|$ , where  $\alpha = 0$  if W is odd and  $\alpha = 1$  if W is even. The EVM

analyser shall then

> calculate EVM<sub>1</sub> with 
$$\Delta \tilde{t}$$
 set to  $\Delta \tilde{c} + \alpha - \left\lfloor \frac{W}{2} \right\rfloor$ 

> calculate EVM<sub>h</sub> with 
$$\Delta \tilde{t}$$
 set to  $\Delta \tilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$ .

## F.5 Window length

#### F.5.1 Timing offset

As a result of using a cyclic prefix, there is a range of  $\Delta \tilde{t}$ , which, at least in the case of perfect Tx signal quality, would give close to minimum error vector magnitude. As a first order approximation, that range should be equal to the length of the cyclic prefix. Any time domain windowing or FIR pulse shaping applied by the transmitter reduces the  $\Delta \tilde{t}$  range within which the error vector is close to its minimum.

#### Window length F.5.2

The window length W affects the measured EVM, and is expressed as a function of the configured cyclic prefix length. In the case where equalization is present, as with frequency domain EVM computation, the effect of FIR is reduced. This is because the equalization can correct most of the linear distortion introduced by the FIR. However, the time domain windowing effect can't be removed.

#### Window length for normal CP F.5.3

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for normal CP. The nominal window length for 3 MHz is rounded down one sample to allow the window to be centered on the symbol.

Channel Bandwidth MHz	Cyclic prefix length <sup>1</sup> $N_{cp}$ for symbol 0	Cyclic prefix length <sup>1</sup> $N_{cp}$ for symbols 1 to 6	Nominal FFT size	Cyclic prefix for symbols 1 to 6 in FFT samples	EVM window length <i>W</i> in FFT samples	Ratio of <i>W</i> to CP for symbols 1 to 6 <sup>2</sup>		
1.4			128	9	5	55.6		
3			256	18	12	66.7		
5	160	144	512	36	32	88.9		
10	100	144	1024	72	66	91.7		
15			1536	108	102	94.4		
20			2048	144	136	94.4		
Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.								

Table F.5.3-1 EVM window length for normal CP

## F.5.4 Window length for Extended CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for extended CP. The nominal window lengths for 3 MHz and 15 MHz are rounded down one sample to allow the window to be centered on the symbol.

Table F.5.4-1 EVM window length for extended CP

Channel Bandwidth MHz	Cyclic prefix length $N_{cp}$	Nominal FFT size	Cyclic prefix in FFT samples	EVM window length <i>W</i> in FFT samples	Ratio of W to CP <sup>2</sup>	
1.4		128	32	28	87.5	
3		256	64	58	90.6	
5	512	512	128	124	96.9	
10	512	1024	256	250	97.4	
15		1536	384	374	97.4	
20	]	2048	512	504	98.4	
Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed. Note 2: These percentages are informative						

## F.5.5 Window length for PRACH

The table below specifies the EVM window length for PRACH preamble formats 0-4.

Table F.5.5-1 EVM window length for PRACH

Preamble format	$\begin{array}{c} \textbf{Cyclic} \\ \textbf{prefix} \\ \textbf{length}^1 \ N_{cp} \end{array}$	Nominal FFT size <sup>2</sup>	EVM window length <i>W</i> in FFT samples	Ratio of <i>W</i> to CP*			
0	3168	24576	3072	96.7%			
1	21024	24576	20928	99.5%			
2	6240	49152	6144	98.5%			
3	21024	49152	20928	99.5%			
4	448	4096	432	96.4%			
	Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed						
	The use of other FFT sizes is possible as long as appropriate scaling of the window length is applied						
Note 3: T	hese percentage	es are informat	ive				

## F.6 Averaged EVM

The general EVM is averaged over basic EVM measurements for 20 slots in the time domain.

$$\overline{EVM} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_i^2}$$

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_1$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_1$  in the expressions above and  $\overline{\text{EVM}}_h$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_h$ .

Thus we get:

$$EVM = \max(EVM_1, EVM_h)$$

The calculation of the EVM for the demodulation reference signal,  $EVM_{DMRS}$ , follows the same procedure as calculating the general EVM, with the exception that the modulation symbol set  $T_m$  defined in clause F.2 is restricted to symbols containing uplink demodulation reference signals.

The basic  $EVM_{DMRS}$  measurements are first averaged over 20 slots in the time domain to obtain an intermediate average  $\overline{EVM}_{DMRS}$ .

$$\overline{EVM}_{DMRS} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_{DMRS,i}^2}$$

In the determination of each  $EVM_{DMRS,i}$ , the timing is set to  $\Delta \tilde{t} = \Delta \tilde{t}_i$  if  $\overline{EVM}_1 > \overline{EVM}_h$ , and it is set to  $\Delta \tilde{t} = \Delta \tilde{t}_i$  otherwise, where  $\overline{EVM}_1$  and  $\overline{EVM}_h$  are the general average EVM values calculated in the same 20 slots over which the intermediate average  $\overline{EVM}_{DMRS}$  is calculated. Note that in some cases, the general average EVM may be calculated only for the purpose of timing selection for the demodulation reference signal EVM.

Then the results are further averaged to get the EVM for the demodulation reference signal, EVM DMRS,

$$EVM_{DMRS} = \sqrt{\frac{1}{6} \sum_{j=1}^{6} \overline{EVM}_{DMRS,j}^2}$$

The PRACH EVM,  $EVM_{PRACH}$ , is averaged over two preamble sequence measurements for preamble formats 0, 1, 2, 3, and it is averaged over 10 preamble sequence measurements for preamble format 4.

The EVM requirements shall be tested against the maximum of the RMS average at the window *W* extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_{\text{PRACH,1}}$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_l$  and  $\overline{\text{EVM}}_{\text{PRACH,h}}$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_h$ .

Thus we get:

 $EVM_{PRACH} = \max(\overline{EVM}_{PRACH,1}, \overline{EVM}_{PRACH,h})$ 

## F.7 Spectrum Flatness

The data shall be taken from FFT coded data symbols and the demodulation reference symbols of the allocated resource block.

## Annex G (informative): Reference sensitivity level in lower SNR

This annex contains information on typical receiver sensitivity when HARQ transmission is enabled allowing operation in lower SNR regions (HARQ is disabled in conformance testing), thus representing the configuration normally used in live network operation under noise-limited conditions.

## G.1 General

The reference sensitivity power level  $P_{SENS}$  with HARQ retransmission enabled (operation in lower SNR) is the minimum mean power applied to both the UE antenna ports at which the residual BLER after HARQ shall meet the requirements for the specified reference measurement channel. The residual BLER after HARQ transmission is defined as follows:

$$BLER_{residual} = 1 - \frac{A}{R}$$

A: Number of correctly decoded MAC PDUs

B: Number of transmitted MAC PDUs (Retransmitted MAC PDUs are not counted)

## G.2 Typical receiver sensitivity performance (QPSK)

The residual BLER after HARQ shall be lower than 1% for the reference measurement channels as specified in Annexes G.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table G.2-1 and Table G.2-2

	Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode	
1				[-102]	, ý	, ,	FDD	
2				TBD			FDD	
3				TBD			FDD	
4				TBD			FDD	
5				TBD			FDD	
6				TBD			FDD	
7				TBD			FDD	
8				TBD			FDD	
9				TBD			FDD	
10				TBD			FDD	
11				TBD			FDD	
12				TBD			FDD	
13				TBD			FDD	
13				TBD			FDD	
				100				
 17				TBD			FDD	
18				TBD			FDD	
19				TBD			FDD	
20				TBD			FDD	
20				TBD			FDD	
22				TBD			FDD	
23				TBD			FDD	
26				TBD			FDD	
20				TBD			FDD	
28				TBD			FDD	
33				[-102]			TDD	
34				[-102]			TDD	
35				[-102]			TDD	
36				[-102]			TDD	
37				[-102]			TDD	
38				[-102]			TDD	
39				[-102]			TDD	
40				[-102]			TDD	
40				[-102]			TDD	
42				[-102]			TDD	
43				[-102]			TDD	
Note 1: T Note 2: R	L he transmitter Reference meas DP.1 FDD/TDD	surement cl as describe	hannel is ( ed in Anne	as defined G.3 with on ex A.5.1.1//	e sided dy			
Note 3: T Note 4: F	he signal powe or the UE whic evel is FFS. or the UE whic	er is specifie h supports	ed per por both Band	t 13 and Bai	nd 9 the ret		-	
	evel is FFS.	in supports	JULI Dall				SCHORINILY	

Table G.2-1: Reference	sensitivity QPSK P <sub>SENS</sub>
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Table G.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement in lower SNR must be met.

	E-UTRA Band / Channel bandwidth / NRB / Duplex mode						
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1				[6] <sup>1</sup>			FDD
2				[6] <sup>1</sup>			FDD
3				[6] <sup>1</sup>			FDD
4				[6] <sup>1</sup>			FDD
5				[6] <sup>1</sup>			FDD
6				[6] <sup>1</sup>			FDD
7				[6] <sup>1</sup>			FDD
8				[6] <sup>1</sup>			FDD
9				[6] <sup>1</sup>			FDD
10				[6] <sup>1</sup>			FDD
11				[6] <sup>1</sup>			FDD
12				[6] <sup>1</sup>			FDD
13				[6] <sup>1</sup>			FDD
14				[6] <sup>1</sup>			FDD
17				[6] <sup>1</sup>			FDD
18				[6] <sup>1</sup>			FDD
19				[6] <sup>1</sup>			FDD
20				[6] <sup>1</sup>			FDD
22				[6] <sup>1</sup>			FDD
21				[6] <sup>1</sup>			FDD
23				[6] <sup>1</sup>			FDD
26				[6] <sup>1</sup>			FDD
27				[6] <sup>1</sup>			FDD
28				[6] <sup>1</sup>			FDD
33				50			TDD
34				50			TDD
35				50			TDD
36				50			TDD
37	1			50			TDD
38				50			TDD
39	1			50			TDD
40	1			50			TDD
42	1			50			TDD
43	1			50			TDD
44	1			50			TDD
Note 2:	Note 1:The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).Note 2:For the UE which supports both Band 11 and Band 21 the minimum						
uplink configuration for reference sensitivity is FFS. Note 3: For Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RBstart _11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RBstart _16							

 Table G.2-2: Minimum uplink configuration for reference sensitivity

Unless given by Table G.2-3, the minimum requirements specified in Tables G.2-1 and G.2-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

E-UTRA Band	Network Signalling value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03
35	NS_03
36	NS_03

Table G.2-3: Network Signalling Value for reference sensitivity
-----------------------------------------------------------------

# G.3 Reference measurement channel for REFSENSE in lower SNR

Tables G.3-1 and G.3-2 are applicable for Annex G.2 (Reference sensitivity level in lower SNR).

Table G.3-1 Fixed	<b>Reference Channe</b>	I for Receiver Re	quirements (	FDD)
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Parameter	Unit	Value
Channel bandwidth	MHz	10
Allocated resource blocks		50
Subcarriers per resource block		12
Allocated subframes per Radio Frame		10
Modulation		QPSK
Target Coding Rate		1/3
Number of HARQ Processes	Processes	8
Maximum number of HARQ transmissions		[4]
Information Bit Payload per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	4392
Transport block CRC	Bits	24
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13800
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	12960
Max. Throughput averaged over 1 frame	kbps	3952.
		8
UE Category		1-8
		IHz and 10MHz channel BW. 3 symbols allocated to
PDCCH for 5 MHz and 3 MHz. 4 s		
		BCH allocated as per TS 36.211 [4]
		ional CRC sequence of $L = 24$ Bits is attached to
each Code Block (otherwise L = 0		
Note 4: Redundancy version coding seque	ence is {0, 1, 2	, 3} for QPSK.

Parameter	Unit	V	alue	
Channel Bandwidth	MHz		10	
Allocated resource blocks			50	
Uplink-Downlink Configuration (Note 5)			1	
Allocated subframes per Radio Frame			4+2	
(D+S)				
Number of HARQ Processes	Processes		7	
Maximum number of HARQ transmission			[4]	
Modulation			QPSK	
Target coding rate			1/3	
Information Bit Payload per Sub-Frame	Bits			
For Sub-Frame 4, 9			4392	
For Sub-Frame 1, 6			3240	
For Sub-Frame 5			N/A	
For Sub-Frame 0			4392	
Transport block CRC	Bits		24	
Number of Code Blocks per Sub-Frame				
(Note 5)				
For Sub-Frame 4, 9			1	
For Sub-Frame 1, 6			1	
For Sub-Frame 5			N/A	
For Sub-Frame 0			1	
Binary Channel Bits Per Sub-Frame	Bits			
For Sub-Frame 4, 9			13800	
For Sub-Frame 1, 6			11256	
For Sub-Frame 5			N/A	
For Sub-Frame 0			13104	
Max. Throughput averaged over 1 frame	kbps		1965.	
			6	
UE Category			1-5	
Note 1: For normal subframes(0,4,5,9), 2 channel BW; 3 symbols allocated for 1.4 MHz. For special subframe	to PDCCH for	5 MHz and 3 MHz; 4 sym	bols allocate	d to PDCCH
Note 2: For 1.4MHz, no data shall be sche insufficient PDCCH performance				
Note 3: Reference signal, Synchronization	n signals and F	PBCH allocated as per TS	36.211 [4]	
Note 4: If more than one Code Block is pr				attached to
each Code Block (otherwise $L = 0$		,		
Note 5: As per Table 4.2-2 in TS 36.211 [	4]			
Note 6: Redundancy version coding sequ	ence is {0, 1, 2	2, 3} for QPSK.		

### Table G.3-2 Fixed Reference Channel for Receiver Requirements (TDD)

## Annex H (normative): Modified MPR behavior

## H.1 Indication of modified MPR behavior

This annex contains the definitions of the bits in the field *modifiedMPRbehavior* indicated in the IE UE Radio Access Capability [7] by a UE supporting an MPR or A-MPR modified in a later release of this specification.

Index of field	Definition	Notes
(bit number)	(description of the supported functionality if indicator	
	set to one)	
0 (leftmost bit)	- The MPR for intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation specified in Clause 6.2.3A in version 12.5.0 of this specification	- This bit can be set to 1 by a UE supporting intra-band contiguous CA bandwidth class C
1	- The A-MPR associated with NS_05 for Band 1 in Clause 6.2.4 in version 12.10.0 of this specification.	- This bit can be set to 1 by a UE supporting A-MPR associated to NS_05 for Band 1.

Table H.1-1: Definitions of the bits in the field modifiedMPRbehavior

## Annex I (informative): Change history

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
11-2007	R4#45	R4-72206				TS36.101V0.1.0 approved by RAN4	
12-2007	RP#38	RP-070979				Approved version at TSG RAN #38	8.0.0
03-2008	RP#39	RP-080123	3			TS36.101 - Combined updates of E-UTRA UE requirements	8.1.0
05-2008	RP#40	RP-080325	4			TS36.101 - Combined updates of E-UTRA UE requirements	8.2.0
09-2008	RP#41	RP-080638	5r1			Addition of Ref Sens figures for 1.4MHz and 3MHz Channel bandwiidths	8.3.0
09-2008	RP#41	RP-080638	7r1			Transmitter intermodulation requirements	8.3.0
09-2008	RP#41	RP-080638	10			CR for clarification of additional spurious emission requirement	8.3.0
09-2008	RP#41	RP-080638	15			Correction of In-band Blocking Requirement	8.3.0
09-2008	RP#41	RP-080638	18r1			TS36.101: CR for section 6: NS_06	8.3.0
09-2008	RP#41	RP-080638	19r1			TS36.101: CR for section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080638	20r1			TS36.101: CR for UE minimum power	8.3.0
09-2008	RP#41	RP-080638	21r1			TS36.101: CR for UE OFF power	8.3.0
09-2008	RP#41	RP-080638	24r1			TS36.101: CR for section 7: Band 13 Rx sensitivity	8.3.0
09-2008	RP#41	RP-080638	26			UE EVM Windowing	8.3.0
09-2008	RP#41	RP-080638	29			Absolute ACLR limit	8.3.0
09-2008	RP#41	RP-080731	23r2			TS36.101: CR for section 6: UE to UE co-existence	8.3.0
09-2008	RP#41	RP-080731	30			Removal of [] for UE Ref Sens figures	8.3.0
09-2008	RP#41	RP-080731	31			Correction of PA, PB definition to align with RAN1 specification	8.3.0
09-2008	RP#41	RP-080731	37r2			UE Spurious emission band UE co-existence	8.3.0
09-2008	RP#41	RP-080731	44			Definition of specified bandwidths	8.3.0
09-2008	RP#41	RP-080731	48r3			Addition of Band 17	8.3.0
09-2008	RP#41	RP-080731	50			Alignment of the UE ACS requirement	8.3.0
09-2008	RP#41	RP-080731	52r1			Frequency range for Band 12	8.3.0
09-2008	RP#41	RP-080731	54r1			Absolute power tolerance for LTE UE power control	8.3.0
09-2008	RP#41	RP-080731	55			TS36.101 section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080732	6r2			DL FRC definition for UE Receiver tests	8.3.0
09-2008	RP#41	RP-080732	46			Additional UE demodulation test cases	8.3.0
09-2008	RP#41	RP-080732	47			Updated descriptions of FRC	8.3.0
09-2008	RP#41	RP-080732	49			Definition of UE transmission gap	8.3.0
09-2008	RP#41	RP-080732	51			Clarification on High Speed train model in 36.101	8.3.0
09-2008	RP#41	RP-080732	53			Update of symbol and definitions	8.3.0
09-2008	RP#41	RP-080743	56			Addition of MIMO (4x2) and (4x4) Correlation Matrices	8.3.0
12-2008	RP#42	RP-080908	94r2			CR TX RX channel frequency separation	8.4.0
12-2008	RP#42	RP-080909	105r1			UE Maximum output power for Band 13	8.4.0
12-2008	RP#42	RP-080909	60			UL EVM equalizer definition	8.4.0
12-2008	RP#42	RP-080909	63			Correction of UE spurious emissions	8.4.0
12-2008	RP#42	RP-080909	66			Clarification for UE additional spurious emissions	8.4.0
12-2008	RP#42	RP-080909	72			Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803	8.4.0
12-2008	RP#42	RP-080909	75			Removal of [] from Section 6 transmitter characteristcs	8.4.0
12-2008	RP#42	RP-080909	81			Clarification for PHS band protection	8.4.0
12-2008	RP#42	RP-080909	101			Alignement for the measurement interval for transmit signal quality	8.4.0
12-2008	RP#42	RP-080909	98r1			Maximum power	8.4.0
12-2008	RP#42	RP-080909	57r1			CR UE spectrum flatness	8.4.0
12-2008	RP#42	RP-080909	71r1			UE in-band emission	8.4.0
12-2008	RP#42	RP-080909	58r1			CR Number of TX exceptions	8.4.0
12-2008	RP#42	RP-080951	99r2			CR UE output power dynamic	8.4.0
12-2008	RP#42	RP-080951	79r1			LTE UE transmitter intermodulation	8.4.0
12-2008	RP#42	RP-080910	91			Update of Clause 8	8.4.0
12-2008	RP#42	RP-080950	106r1			Structure of Clause 9 including CSI requirements for PUCCH mode 1-0	8.4.0
12-2008	RP#42	RP-080911	59			CR UE ACS test frequency offset	8.4.0
12-2008	RP#42	RP-080911	65			Correction of spurious response parameters	8.4.0
12-2008	RP#42	RP-080911	80		1	Removal of LTE UE narrowband intermodulation	8.4.0

### Table H-1: Change History

12-2008	RP#42	RP-080911	90r1	Introduction of Maximum Sensitivity Degradation	8.4.0
12-2008	RP#42	RP-080911	103	Removal of [] from Section 7 Receiver characteristic	8.4.0
12-2008	RP#42	RP-080912	62	Alignement of TB size n Ref Meas channel for RX characteristics	8.4.0
12-2008	RP#42	RP-080912	78	TDD Reference Measurement channel for RX characterisctics	8.4.0
12-2008 12-2008	RP#42 RP#42	RP-080912 RP-080912	73r1 74r1	Addition of 64QAM DL reference measurement channel Addition of UL Reference Measurement Channels	8.4.0 8.4.0
12-2008	RP#42	RP-080912 RP-080912	104	Reference measurement channels for PDSCH performance	8.4.0
12-2008	RP#42	RP-080912	68	requirements (TDD) MIMO Correlation Matrix Corrections	8.4.0
12-2008	RP#42	RP-080915	67	Correction to the figure with the Transmission Bandwidth	8.4.0
				configuration	8.4.0
12-2008 12-2008	RP#42 RP#42	RP-080916 RP-080917	77 85r1	Modification to EARFCN New Clause 5 outline	8.4.0
12-2008	RP#42	RP-080919	102	Introduction of Bands 12 and 17 in 36.101	8.4.0
12-2008	RP#42	RP-080927	84r1	Clarification of HST propagation conditions	8.4.0
03-2009	RP#43	RP-090170	156r2	A-MPR table for NS_07	8.5.0
03-2009	RP#43	RP-090170	170	Corrections of references (References to tables and figures)	8.5.0
03-2009	RP#43	RP-090170	108	Removal of [] from Transmitter Intermodulation	8.5.0
03-2009	RP#43	RP-090170	155	E-UTRA ACLR for below 5 MHz bandwidths	8.5.0
03-2009	RP#43	RP-090170	116	Clarification of PHS band including the future plan	8.5.0
03-2009	RP#43	RP-090170	119	Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts	8.5.0
03-2009	RP#43	RP-090170	120	Removal of "Out-of-synchronization handling of output power" heading	8.5.0
03-2009	RP#43	RP-090170	126	UE uplink power control	8.5.0
03-2009	RP#43	RP-090170	128	Transmission BW Configuration	8.5.0
03-2009	RP#43	RP-090170	130	Spectrum flatness	8.5.0
03-2009	RP#43	RP-090170	132r2	PUCCH EVM	8.5.0
03-2009	RP#43	RP-090170	134	UL DM-RS EVM	8.5.0
03-2009	RP#43	RP-090170	140	Removal of ACLR2bis requirements	8.5.0
03-2009	RP#43	RP-090171	113	In-band blocking	8.5.0
03-2009	RP#43	RP-090171	127	In-band blocking and sensitivity requirement for band 17	8.5.0
03-2009	RP#43	RP-090171	137r1	Wide band intermodulation	8.5.0
03-2009	RP#43	RP-090171	141	Correction of reference sensitivity power level of Band 9	8.5.0
03-2009	RP#43	RP-090172	109	AWGN level for UE DL demodulation performance tests	8.5.0
03-2009	RP#43	RP-090172 RP-090172	124	Update of Clause 8: additional test cases	8.5.0 8.5.0
03-2009 03-2009	RP#43 RP#43	RP-090172 RP-090172	139r1 142r1	Performance requirement structure for TDD PDSCH Performance requirements and reference measurement channels for TDD PDSCH demodulation with UE-specific	8.5.0
03-2009	RP#43	RP-090172	145	reference symbols Number of information bits in DwPTS	8.5.0
	-		160r1		
03-2009	RP#43	RP-090172		MBSFN-Unicast demodulation test case	8.5.0
03-2009	RP#43	RP-090172	163r1	MBSFN-Unicast demodulation test case for TDD	8.5.0
03-2009	RP#43	RP-090173	162	Clarification of EARFCN for 36.101	8.5.0
03-2009	RP#43	RP-090369	110	Correction to UL Reference Measurement Channel	8.5.0
03-2009	RP#43	RP-090369	114	Addition of MIMO (4x4, medium) Correlation Matrix	8.5.0
03-2009	RP#43	RP-090369	121	Correction of 36.101 DL RMC table notes	8.5.0
03-2009	RP#43	RP-090369	125	Update of Clause 9	8.5.0
03-2009	RP#43	RP-090369	138r1	Clarification on OCNG	8.5.0
	-		161		
03-2009	RP#43	RP-090369	164	CQI reference measurement channels	8.5.0
03-2009	RP#43	RP-090369	_	PUCCH 1-1 Static Test Case	8.5.0
03-2009	RP#43	RP-090369	111	Reference Measurement Channel for TDD	8.5.0
03-2009	RP#44			Editorial correction in Table 6.2.4-1	8.5.1
05-2009	RP#44	RP-090540	167	Boundary between E-UTRA fOOB and spurious emission domain for 1.4 MHz and 3 MHz bandwiths. (Technically Endorsed CR in R4-50bis - R4-091205)	8.6.0
05-2009	RP#44	RP-090540	168	EARFCN correction for TDD DL bands. (Technically Endorsed CR in R4-50bis - R4-091206)	8.6.0
05-2009	RP#44	RP-090540	169	Editorial correction to in-band blocking table. (Technically	8.6.0

				Endorsed CR in R4-50bis - R4-091238)	
05-2009	RP#44	RP-090540	171	CR PRACH EVM. (Technically Endorsed CR in R4-50bis - R4- 091308)	8.6.0
05-2009	RP#44	RP-090540	172	CR EVM correction. (Technically Endorsed CR in R4-50bis - R4- 091309)	8.6.0
05-2009	RP#44	RP-090540	177	CR power control accuracy. (Technically Endorsed CR in R4- 50bis - R4-091418)	8.6.0
05-2009	RP#44	RP-090540	179	Correction of SRS requirements. (Technically Endorsed CR in R4-50bis - R4-091426)	8.6.0
05-2009	RP#44	RP-090540	186	Clarification for EVM. (Technically Endorsed CR in R4-50bis - R4-091512)	8.6.0
05-2009	RP#44	RP-090540	187	Removal of [] from band 17 Refsens values and ACS offset frequencies	8.6.0
05-2009	RP#44	RP-090540	191	Completion of band17 requirements	8.6.0
05-2009	RP#44	RP-090540	192	Removal of 1.4 MHz and 3 MHz bandwidths from bands 13, 14 and 17.	8.6.0
05-2009	RP#44	RP-090540	223	CR: 64 QAM EVM	8.6.0
05-2009	RP#44	RP-090540	201	CR In-band emissions	8.6.0
05-2009	RP#44	RP-090540	203	CR EVM exclusion period	8.6.0
05-2009	RP#44	RP-090540	204	CR In-band emissions timing	8.6.0
05-2009	RP#44	RP-090540	206	CR Minimum Rx exceptions	8.6.0
05-2009	RP#44	RP-090540	207	CR UL DM-RS EVM	8.6.0
05-2009	RP#44	RP-090540	218r1	A-MPR table for NS_07	8.6.0
05-2009	RP#44	RP-090540	205r1	CR In-band emissions in shortened subframes	8.6.0
05-2009	RP#44	RP-090540	200r1	CR PUCCH EVM	8.6.0
05-2009	RP#44	RP-090540	178r2	No additional emission mask indication. (Technically Endorsed CR in R4-50bis - R4-091421)	8.6.0
05-2009	RP#44	RP-090540	220r1	Spectrum emission requirements for band 13	8.6.0
05-2009	RP#44	RP-090540	197r2	CR on aggregate power tolerance	8.6.0
05-2009	RP#44	RP-090540	196r2	CR: Rx IP2 performance	8.6.0
05-2009	RP#44	RP-090541	198r1	Maximum output power relaxation	8.6.0
05-2009	RP#44	RP-090542	166	Update of performance requirement for TDD PDSCH with MBSFN configuration. (Technically Endorsed CR in R4-50bis - R4-091180)	8.6.0
05-2009	RP#44	RP-090542	175	Adding AWGN levels for some TDD DL performance requirements. (Technically Endorsed CR in R4-50bis - R4- 091406)	8.6.0
05-2009	RP#44	RP-090542	182	OCNG Patterns for Single Resource Block FRC Requirements. (Technically Endorsed CR in R4-50bis - R4-091504)	8.6.0
05-2009	RP#44	RP-090542	170r1	Update of Clause 8: PHICH and PMI delay. (Technically Endorsed CR in R4-50bis - R4-091275)	8.6.0
05-2009	RP#44	RP-090543	183	Requirements for frequency-selective fading test. (Technically Endorsed CR in R4-50bis - R4-091505)	8.6.0
05-2009	RP#44	RP-090543	199	CQI requirements under AWGN conditions	8.6.0
05-2009	RP#44	RP-090543	188r1	Adaptation of UL-RMC-s for supporting more UE categories	8.6.0
05-2009	RP#44	RP-090543	193r1	Correction of the LTE UE downlink reference measurement channels	8.6.0
05-2009	RP#44	RP-090543	184r1	Requirements for frequency non-selective fading tests. (Technically Endorsed CR in R4-50bis - R4-091506)	8.6.0
05-2009	RP#44	RP-090543	185r1	Requirements for PMI reporting. (Technically Endorsed CR in R4-50bis - R4-091510)	8.6.0
05-2009	RP#44	RP-090543	221r1	Correction to DL RMC-s for Maximum input level for supporting more UE-Categories	8.6.0
05-2009	RP#44	RP-090543	216	Addition of 15 MHz and 20 MHz bandwidths into band 38 Introduction of Extended LTE800 requirements. (Technically	8.6.0
05-2009	RP#44	RP-090559	180	Endorsed CR in R4-50bis - R4-091432)	9.0.0
09-2009	RP#45	RP-090826	239	A-MPR for Band 19 LTE UTRA ACLR1 centre frequency definition for 1.4 and 3 MHz	9.1.0
09-2009	RP#45	RP-090822	225	BW	9.1.0
09-2009	RP#45	RP-090822	227	Harmonization of text for LTE Carrier leakage	9.1.0
09-2009	RP#45	RP-090822	229	Sensitivity requirements for Band 38 15 MHz and 20 MHz bandwidths	9.1.0
09-2009	RP#45	RP-090822	236	Operating band edge relaxation of maximum output power for Band 18 and 19	9.1.0
09-2009	RP#45	RP-090822	238	Addition of 5MHz channel bandwidth for Band 40	9.1.0
09-2009	RP#45	RP-090822	245	Removal of unnecessary requirements for 1.4 and 3 MHz bandwidths on bands 13 and 17	9.1.0
09-2009	RP#45	RP-090877	261	Correction of LTE UE ACS test parameter	9.1.0
09-2009	RP#45	RP-090877	263R1	Correction of LTE UE ACLR test parameter	9.1.0
09-2009	RP#45	RP-090877	286	Uplink power and RB allocation for receiver tests	9.1.0
09-2009	RP#45	RP-090877	320	CR Sensitivity relaxation for small BW	9.1.0

09-2009	RP#45	RP-090877	324	Correction of Band 3 spurious emission band UE co-existence	9.1.0
09-2009	RP#45	RP-090877	249R1	CR Pcmax definition (working assumption)	9.1.0
09-2009	RP#45	RP-090877	330	Spectrum flatness clarification	9.1.0
09-2009	RP#45	RP-090877	332	Transmit power: removal of TC and modification of REFSENS note	9.1.0
09-2009	RP#45	RP-090877	282R1	Additional SRS relative power requirement and update of measurement definition	9.1.0
09-2009	RP#45	RP-090877	284R1	Power range applicable for relative tolerance	9.1.0
09-2009	RP#45	RP-090878	233	TDD UL/DL configurations for CQI reporting	9.1.0
09-2009	RP#45	RP-090878	235	Further clarification on CQI test configurations	9.1.0
09-2009	RP#45	RP-090878	243	Corrections to UL- and DL-RMC-s	9.1.0 9.1.0
09-2009 09-2009	RP#45 RP#45	RP-090878 RP-090878	247 290	Reference measurement channel for multiple PMI requirements           CQI reporting test for a scenario with frequency-selective	9.1.0
09-2009	RP#45		265R2	interference	9.1.0
09-2009	RP#45	RP-090878 RP-090878	265R2 321R1	CQI reference measurement channels CR RI Test	9.1.0
				Correction of parameters for demodulation performance	
09-2009	RP#45	RP-090875	231	requirement UE categories for performance tests and correction to RMC	9.1.0
09-2009	RP#45	RP-090875	241R1	references	9.1.0
09-2009	RP#45	RP-090875	333	Clarification of Ês definition in the demodulation requirement	9.1.0 9.1.0
09-2009 09-2009	RP#45 RP#45	RP-090875 RP-090875	326 259R3	Editorial corrections and updates to PHICH PBCH test cases. Test case numbering in section 8 Performance tests	9.1.0
12-2009	RP-46	RP-090875 RP-091264	259R3 335	Test case numbering in TDD PDSCH performance test	9.2.0
	-			(Technically endorsed at RAN 4 52bis in R4-093523) Adding beamforming model for user-specific reference signal	
12-2009	RP-46	RP-091261	337	(Technically endorsed at RAN 4 52bis in R4-093525) Adding redundancy sequences to PMI test (Technically	9.2.0
12-2009	RP-46	RP-091263	339R1	endorsed at RAN 4 52bis in R4-093581)	9.2.0
12-2009	RP-46	RP-091264	341	Throughput value correction at FRC for Maximum input level (Technically endorsed at RAN 4 52bis in R4-093660)	9.2.0
12-2009	RP-46	RP-091261	343	Correction to the modulated E-UTRA interferer (Technically endorsed at RAN 4 52bis in R4-093662)	9.2.0
12-2009	RP-46	RP-091264	345R1	OCNG: Patterns and present use in tests (Technically endorsed at RAN 4 52bis in R4-093664)	9.2.0
12-2009	RP-46	RP-091264	347	OCNG: Use in receiver and performance tests (Technically endorsed at RAN 4 52bis in R4-093666)	9.2.0
12-2009	RP-46	RP-091263	349	Miscellaneous corrections on CSI requirements (Technically endorsed at RAN 4 52bis in R4-093676)	9.2.0
12-2009	RP-46	RP-091261	351	Removal of RLC modes (Technically endorsed at RAN 4 52bis in R4-093677)	9.2.0
12-2009	RP-46	RP-091261	353	CR Rx diversity requirement (Technically endorsed at RAN 4 52bis in R4-093703)	9.2.0
12-2009	RP-46	RP-091261	355	A-MPR notation in NS_07 (Technically endorsed at RAN 4 52bis in R4-093706)	9.2.0
12-2009	RP-46	RP-091263	359	Single- and multi-PMI requirements (Technically endorsed at RAN 4 52bis in R4-093846)	9.2.0
12-2009	RP-46	RP-091263	363	CQI reference measurement channel (Technically endorsed at RAN 4 52bis in R4-093970)	9.2.0
12-2009	RP-46	RP-091292	364	LTE MBSFN Channel Model (Technically endorsed at RAN 4 52bis in R4-094020)	9.2.0
12-2009	RP-46	RP-091264	367	Numbering of PDSCH (User-Specific Reference Symbols) Demodulation Tests	9.2.0
12-2009	RP-46	RP-091264	369	Numbering of PDCCH/PCFICH, PHICH, PBCH Demod Tests	9.2.0
12-2009	RP-46	RP-091261	371	Remove [] from Reference Measurement Channels in Annex A	9.2.0
12-2009	RP-46	RP-091264	373R1	Corrections to RMC-s for Maximum input level test for low UE categories	9.2.0
12-2009 12-2009	RP-46 RP-46	RP-091261 RP-091286	377 378	Correction of UE-category for R.30 Introduction of Extended LTE1500 requirements for TS36.101	9.2.0 9.2.0
12-2009	KF-40	KE-091200	310	CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from	9.2.0
12-2009	RP-46	RP-091262	384	additional spurious emissions requirements for Band 1 PHS protection	9.2.0
12-2009	RP-46	RP-091262	386R3	Clarification of measurement conditions of spurious emission requirements at the edge of spurious domain	9.2.0
12-2009	RP-46	RP-091262	390	Spurious emission table correction for TDD bands 33 and 38.	9.2.0
12-2009	RP-46	RP-091262	392R2	36.101 Symbols and abreviations for Pcmax	9.2.0
12-2009	RP-46	RP-091262	394	UTRAACLR1 requirement definition for 1.4 and 3 MHz BW completed	9.2.0
12-2009	RP-46	RP-091263	396	Introduction of the ACK/NACK feedback modes for TDD requirements	9.2.0
12-2009	RP-46	RP-091262	404R3	CR Power control exception R8	9.2.0
12-2009	RP-46	RP-091262	416R1	Relative power tolerance: special case for receiver tests	9.2.0
12-2009	RP-46	RP-091263	420R1	CSI reporting: test configuration for CQI fading requirements	9.2.0

12-2009	RP-46	RP-091284	421R1	Inclusion of Band 20 UE RF parameters	9.2.0
12-2009	RP-46	RP-091264	425	Editorial corrections and updates to Clause 8.2.1 FDD	9.2.0
12-2009	RP-46	RP-091262	427	demodulation test cases CR: time mask	9.2.0
12-2009	RP-46	RP-091264	430	Correction of the payload size for PDCCH/PCFICH performance	9.2.0
				requirements Transport format and test point updates to RI reporting test	
12-2009	RP-46	RP-091263	432	cases	9.2.0
12-2009	RP-46	RP-091263	434	Transport format and test setup updates to frequency-selective interference CQI tests	9.2.0
12-2009	RP-46	RP-091263	436	CR RI reporting configuration in PUCCH 1-1 test	9.2.0
12-2009	RP-46	RP-091261	438	Addition of R.11-1 TDD references	9.2.0
12-2009	RP-46	RP-091292	439	Performance requirements for LTE MBMS	9.2.0
12-2009 12-2009	RP-46 RP-46	RP-091262 RP-091262	442R1 444R1	In Band Emissions Requirements Correction CR PCMAX definition	9.2.0 9.2.0
03-2009	RP-46 RP-47	RP-091262 RP-100246	444R 1 453r1	Corrections of various errors in the UE RF requirements	9.2.0
03-2010	RP-47	RP-100246	462r1	UTRA ACLR measurement bandwidths for 1.4 and 3 MHz	9.3.0
03-2010	RP-47	RP-100246	493	Band 8 Coexistence Requirement Table Correction	9.3.0
03-2010	RP-47	RP-100246	489r1	Rel 9 CR for Band 14	9.3.0
03-2010	RP-47	RP-100246	485r1	CR Band 1- PHS coexistence	9.3.0
03-2010	RP-47	RP-100247	501	Fading CQI requirements for FDD mode	9.3.0
03-2010	RP-47	RP-100247	499	CR correction to RI test	9.3.0
03-2010	RP-47	RP-100249	451	Reporting mode, Reporting Interval and Editorial corrections for demodulation	9.3.0
03-2010	RP-47	RP-100249	464r1	Corrections to 1PRB PDSCH performance test in presence of	9.3.0
				MBSFN.	
03-2010	RP-47	RP-100249	458r1	OCNG corrections	9.3.0
03-2010	RP-47	RP-100249	467	Addition of ONCG configuration in DRS performance test	9.3.0
03-2010	RP-47	RP-100249	465r1	PDSCH performance tests for low UE categories	9.3.0
03-2010	RP-47	RP-100250	460r1	Use of OCNG in CSI tests	9.3.0
03-2010	RP-47	RP-100250	491r1	Corrections to CQI test configurations	9.3.0
03-2010	RP-47	RP-100250	469r1	Corrections of some CSI test parameters TBS correction for RMC UL TDD 16QAM full allocation BW 1.4	9.3.0
03-2010	RP-47	RP-100251	456r1	MHz	9.3.0
03-2010	RP-47	RP-100262	449	Editorial corrections on Band 19 REFSENS	9.3.0
03-2010	RP-47	RP-100263	470r1	Band 20 UE RF requirements	9.3.0
03-2010	RP-47	RP-100264	446r1	A-MPR for Band 21	9.3.0
03-2010	RP-47	RP-100264	448	RF requirements for UE in later releases	9.3.0
03-2010	RP-47	RP-100268	445	36.101 CR: Editorial corrections on LTE MBMS reference measurement channels	9.3.0
03-2010	RP-47	RP-100268	454	The definition of the Doppler shift for LTE MBSFN Channel Model	9.3.0
03-2010	RP-47	RP-100239	478r3	Modification of the spectral flatness requirement and some editorial corrections	9.3.0
06-2010	RP-48	RP-100619	559	Corrections of tables for Additional Spectrum Emission Mask	9.4.0
06-2010	RP-48	RP-100619	538	Correction of transient time definition for EVM requirements	9.4.0
06-2010	RP-48	RP-100619	557r2	CR on UE coexistence requirement	9.4.0
06-2010	RP-48			Correction of antenna configuration and beam-forming model for	9.4.0
06-2010	RP-40	RP-100619	547r1	DRS CR: Corrections on MIMO demodulation performance	
	RP-48	RP-100619	536r1	requirements	9.4.0
06-2010	RP-48	RP-100619	528r1	Corrections on the definition of PCMAX	9.4.0
06-2010				Relaxation of the PDSCH demodulation requirements due to	9.4.0
	RP-48	RP-100619	568	control channel errors	
06-2010	RP-48	RP-100619	566	Correction of the UE output power definition for RX tests	9.4.0
06-2010	RP-48	RP-100620	505r1	Fading CQI requirements for TDD mode	9.4.0
06-2010	RP-48	RP-100620	521	Correction to FRC for CQI index 0	9.4.0
06-2010	RP-48	RP-100620	516r1	Correction to CQI test configuration Correction of CQI and PMI delay configuration description for	9.4.0
06-2010	RP-48	RP-100620	532	TDD	9.4.0
06-2010	RP-48	RP-100620	574	Correction to FDD and TDD CSI test configurations	9.4.0
06-2010	RP-48	RP-100620	571	Minimum requirements for Rank indicator reporting	9.4.0
06-2010	RP-48	RP-100628	563	LTE MBMS performance requirements (FDD)	9.4.0
06-2010	RP-48	RP-100628	564	LTE MBMS performance requirements (TDD)	9.4.0
06-2010	RP-48	RP-100629	553r2	Performance requirements for dual-layer beamforming	9.4.0
06-2010	RP-48	RP-100630	524r2	CR: low Category CSI requirement	9.4.0
06-2010	RP-48	RP-100630	519	Correction of FRC reference and test case numbering	9.4.0
06-2010	RP-48	RP-100630	526	Correction of carrier frequency and EARFCN of Band 21 for TS36.101	9.4.0
06-2010				Addition of PDSCH TDD DRS demodulation tests for Low UE	9.4.0
06-2010	RP-48	RP-100630	508r1	categories Specification of minimum performance requirements for low UE	9.4.0
	RP-48	RP-100630	539	category	
06-2010	RP-48	RP-100630	569	Addition of minimum performance requirements for low UE	9.4.0

				category TDD CRS single-antenna port tests	
06-2010				Introduction of sustained downlink data-rate performance	9.4.0
00.0040	RP-48	RP-100631	549r3	requirements	
06-2010	RP-48 RP-49	RP-100683 RP-100920	530r1 614r2	Band 20 Rx requirements Add OCNG to MBMS requirements	9.4.0 9.5.0
09-2010	RP-49 RP-49	RP-100920	599	Correction of PDCCH content for PHICH test	9.5.0
09-2010	RP-49	RP-100910	597r1	Beamforming model for transmission on antenna port 7/8	9.5.0
09-2010	RP-49	RP-100920	600r1	Correction of full correlation in frequency-selective CQI test	9.5.0
				Correction on single-antenna transmission fixed reference	
09-2010	RP-49	RP-100920	601	channel	9.5.0
09-2010				Reference sensitivity requirements for the 1.4 and 3 MHz	
	RP-49	RP-100914	605	bandwidths	9.5.0
09-2010	RP-49	RP-100920	608r1	CR for DL sustained data rate test	9.5.0
09-2010	RP-49	RP-100919	611	Correction of references in section 10 (MBMS performance requirements)	9.5.0
09-2010	RP-49 RP-49	RP-100919	613	Band 13 and Band 14 spurious emission corrections	9.5.0
09-2010	RP-49	RP-100919	617r1	Rx Requirements	9.5.0
09-2010	RP-49	RP-100926	576r1	Clarification on DL-BF simulation assumptions	9.5.0
09-2010	RP-49	RP-100920	582r1	Introduction of additional Rel-9 scenarios	9.5.0
09-2010	RP-49	RP-100925	575r1	Correction to band 20 ue to ue Co-existence table	9.5.0
09-2010	RP-49	RP-100916	581r1	Test configuration corrections to CQI reporting in AWGN	9.5.0
09-2010	RP-49	RP-100916	595	Corrections to RF OCNG Pattern OP.1 and 2	9.5.0
09-2010	RP-49	RP-100919	583	Editorial corrections of 36.101	9.5.0
09-2010				Addition of minimum performance requirements for low UE	
0.0040	RP-49	RP-100920	586	category TDD tests	9.5.0
09-2010	RP-49	RP-100914	590r1	Downlink power for receiver tests	9.5.0
09-2010	RP-49 RP-49	RP-100920	591 593	OCNG use and power in beamforming tests Throughput for multi-datastreams transmissions	9.5.0 9.5.0
09-2010 09-2010	RP-49 RP-49	RP-100916 RP-100914	588	Missing note in Additional spurious emission test with NS_07	9.5.0
09-2010	RP-49	RP-100914	596r2	CR LTE_TDD_2600_US spectrum band definition additions to	10.0.0
00 2010		1000027	00012	TS 36.101	10.0.0
12-2010	RP-50	RP-101309	680	Demodulation performance requirements for dual-layer	10.1.0
12-2010	RP-50	RP-101325	672	beamforming Correction on the statement of TB size and subband selection in	10.1.0
				CSI tests	
12-2010	RP-50	RP-101327	652	Correction to Band 12 frequency range	10.1.0
12-2010	RP-50	RP-101329	630	Removal of [] from TDD Rank Indicator requirements	10.1.0
12-2010	RP-50	RP-101329	635r1	Test configuration corrections to CQI TDD reporting in AWGN	10.1.0
40.0040	<b>DD 50</b>	DD 404000	045	(Rel-10)	40.4.0
12-2010	RP-50 RP-50	RP-101330	645	EVM window length for PRACH	10.1.0
12-2010 12-2010	RP-50	RP-101330 RP-101330	649 642r1	Removal of NS signalling from TDD REFSENS tests Correction of Note 4 In Table 7.3.1-1: Reference sensitivity	10.1.0
				QPSK PREFSENS	
12-2010	RP-50	RP-101341	627	Add 20 RB UL Ref Meas channel	10.1.0
12-2010	RP-50	RP-101341	654r1	Additional in-band blocking requirement for Band 12	10.1.0
12-2010	RP-50	RP-101341	678	Further clarifications for the Sustained Downlink Data Rate Test	10.1.0
12-2010 12-2010	RP-50 RP-50	RP-101341 RP-101349	673r1 667r3	Correction on MBMS performance requirements CR Removing brackets of Band 41 reference sensitivity to TS	10.1.0
12-2010	KF-30	KF-101349	00/13	36.101	10.1.0
12-2010	RP-50	RP-101356	666r2	Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for TS	10.1.0
10 0010	RP-50	DD 101250	646r1	36.101 CR for CA, UL-MIMO, eDL-MIMO, CPE	10.1.0
12-2010 12-2010	RP-50	RP-101359 RP-101361	620r1	Introduction of L-band in TS 36.101	10.1.0
12-2010	RP-50	RP-101301	670r1	Correction on the PMI reporting in Multi-Laye Spatial	10.1.0
				Multiplexing performance test	
12-2010	RP-50	RP-101380	679r1	Adding antenna configuration in CQI fading test case	10.1.0
01-2011				Clause numbering correction	10.1.1
03-2011	RP-51	RP-110359	695	Removal of E-UTRA ACLR for CA	10.2.0
03-2011	RP-51	RP-110338	699	PDCCH and PHICH performance: OCNG and power settings	10.2.0
03-2011	RP-51	RP-110336	706r1	Spurious emissions measurement uncertainty	10.2.0
	RP-51	RP-110352	707r1	REFSENSE in lower SNR	10.2.0
	RP-51	RP-110338	710 715r2	PMI performance: Power settings and precoding granularity	10.2.0
03-2011				Definition of configured transmitted power for Rel-10	10.2.0
03-2011 03-2011	RP-51	RP-110359			10.2.0
03-2011 03-2011		RP-110359 RP-110359	717	Introduction of requirement for adjacent intraband CA image rejection	
03-2011 03-2011 03-2011	RP-51 RP-51 RP-51	RP-110359 RP-110343	717 719	rejection Minimum requirements for the additional Rel-9 scenarios	10.2.0
03-2011 03-2011 03-2011 03-2011	RP-51 RP-51	RP-110359	717	rejection         Minimum requirements for the additional Rel-9 scenarios         Corrections to power settings for Single layer beamforming with	
03-2011 03-2011 03-2011 03-2011 03-2011 03-2011	RP-51 RP-51 RP-51 RP-51	RP-110359 RP-110343 RP-110343	717       719       723	rejection         Minimum requirements for the additional Rel-9 scenarios         Corrections to power settings for Single layer beamforming with simultaneous transmission	10.2.0 10.2.0
03-2011 03-2011 03-2011 03-2011 03-2011 03-2011	RP-51 RP-51 RP-51 RP-51 RP-51	RP-110359 RP-110343 RP-110343 RP-110343	717       719       723       726r1	rejection         Minimum requirements for the additional Rel-9 scenarios         Corrections to power settings for Single layer beamforming with simultaneous transmission         Correction to the PUSCH3-0 subband tests for Rel-10	10.2.0 10.2.0 10.2.0
03-2011 03-2011 03-2011 03-2011 03-2011 03-2011 03-2011 03-2011 03-2011 03-2011	RP-51 RP-51 RP-51 RP-51	RP-110359 RP-110343 RP-110343	717       719       723	rejection         Minimum requirements for the additional Rel-9 scenarios         Corrections to power settings for Single layer beamforming with simultaneous transmission         Correction to the PUSCH3-0 subband tests for Rel-10         Removing the square bracket for TS36.101         Removal of square brackets for dual-layer beamforming	10.2.0 10.2.0
03-2011 03-2011 03-2011 03-2011 03-2011 03-2011 03-2011	RP-51 RP-51 RP-51 RP-51 RP-51 RP-51	RP-110359 RP-110343 RP-110343 RP-110343 RP-110338	717       719       723       726r1       730	rejection         Minimum requirements for the additional Rel-9 scenarios         Corrections to power settings for Single layer beamforming with simultaneous transmission         Correction to the PUSCH3-0 subband tests for Rel-10         Removing the square bracket for TS36.101	10.2.0 10.2.0 10.2.0 10.2.0

03-2011	RP-51	RP-110343	756r1	Further clarifications for the Sustained Downlink Data Rate Test	10.2.0
03-2011	RP-51 RP-51	RP-110343 RP-110343	759	Removal of square brackets in sustained data rate tests	10.2.0
03-2011	RP-51	RP-110343	762r1	Clarification to LTE relative power tolerance table	10.2.0
03-2011	RP-51	RP-110343	764	Introducing UE-selected subband CQI tests	10.2.0
03-2011	RP-51	RP-110343	765	Verification framework for PUSCH 2-2 and PUCCH 2-1 reporting	10.2.0
04-2011				Editorial: Spec Title correction, removal of "Draft"	10.2.1
06-2011	RP-52	RP-110804	766	Add Expanded 1900MHz Band (Band 25) in 36.101	10.3.0
06-2011	RP-52	RP-110795	768	Fixing Band 24 inclusion in TS 36.101	10.3.0
06-2011	RP-52	RP-110788	772	CR: Corrections for UE to UE co-existence requirements of Band	10.3.0
				3	
06-2011	RP-52	RP-110812	774	Add 2GHz S-Band (Band 23) in 36.101	10.3.0
06-2011	RP-52	RP-110789	782	CR: Band 19 A-MPR refinement	10.3.0
06-2011	RP-52	RP-110796	787	REFSENS in lower SNR	10.3.0
06-2011	RP-52	RP-110789	805	Clarification for MBMS reference signal levels	10.3.0
06-2011	RP-52	RP-110792	810	FDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110787	814	Correction on CQI mapping index of RI test	10.3.0
06-2011	RP-52	RP-110789	824	Corrections to in-band blocking table	10.3.0
06-2011	RP-52	RP-110794	826	Correction of TDD Category 1 DRS and DMRS RMCs	10.3.0
06-2011 06-2011	RP-52 RP-52	RP-110794 RP-110796	828 829	TDD MBMS performance requirements for 64QAM mode Correction of TDD RMC for Low SNR Demodulation test	10.3.0 10.3.0
06-2011	RP-52 RP-52	RP-110796	830	Informative reference sensitivity requirements for Low SNR for	10.3.0
06-2011	RP-52	RP-110/96	830	TDD	10.3.0
06-2011	RP-52	RP-110787	778r1	Minor corrections to DL-RMC-s for Maximum input level	10.3.0
06-2011	RP-52	RP-110789	832	PDCCH and PHICH performance: OCNG and power settings	10.3.0
06-2011	RP-52	RP-110789	818r1	Correction on 2-X PMI test for R10	10.3.0
06-2011	RP-52	RP-110791	816r1	Addition of performance requirements for dual-layer	10.3.0
				beamforming category 1 UE test	
06-2011	RP-52	RP-110789	834	Performance requirements for PUCCH 2-0, PUCCH 2-1 and PUSCH 2-2 tests	10.3.0
06-2011	RP-52	RP-110807	835r1	CR for UL MIMO and CA	10.3.0
09-2011	RP-53	RP-111248	862r1	Removal of unnecessary channel bandwidths from REFSENS	10.4.0
				tables	
09-2011	RP-53	RP-111248	869r1	Clarification on BS precoding information field for RI FDD and PUCCH 2-1 PMI tests	10.4.0
09-2011	RP-53	RP-111248	872r1	CR for B14Rx requirement Rrel 10	10.4.0
09-2011	RP-53	RP-111248	890r1	CR to TS36.101: Correction on the accuracy test of CQI.	10.4.0
09-2011	RP-53	RP-111248	893	CR to TS36.101: Correction on CQI mapping index of TDD RI test	10.4.0
09-2011	RP-53	RP-111248	904	Correction of code block numbers for some RMCs	10.4.0
09-2011	RP-53	RP-111248	907	Correction to UL RMC for FDD and TDD	10.4.0
09-2011	RP-53	RP-111248	914r1	Adding codebook subset restriction for single layer closed-loop spatial multiplexing test	10.4.0
09-2011	RP-53	RP-111251	883	Sustained data rate: Correction of the ACK/NACK feedback mode	10.4.0
09-2011	RP-53	RP-111251	929	36.101 CR on MBSFN FDD requirements(R10)	10.4.0
09-2011	RP-53	RP-111251	938	TDD MBMS performance requirements for 64QAM mode	10.4.0
09-2011	RP-53	RP-111252	895	Further clarification for the dual-layer beamforming demodulation requirements	10.4.0
09-2011	RP-53	RP-111255	908r1	Introduction of Band 22	10.4.0
09-2011	RP-53	RP-111255	939	Modifications of Band 42 and 43	10.4.0
09-2011	RP-53	RP-111260	944	CR for TS 36.101 Annex B: Static channels for CQI tests	10.4.0
09-2011	RP-53	RP-111262	878r1	Correction of CSI reference channel subframe description	10.4.0
09-2011	RP-53	RP-111262	887	Correction to UL MIMO	10.4.0
09-2011	RP-53	RP-111262	926r1	Power control accuracy for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	927r1	In-band emissions requirements for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	930r1	Adding the operating band for UL-MIMO	10.4.0
09-2011	RP-53	RP-111265	848	Corrections to intra-band contiguous CA RX requirements	10.4.0
09-2011	RP-53	RP-111265	863	Intra-band contiguos CA MPR requirement refinement	10.4.0
09-2011	RP-53	RP-111265	866r1	Intra-band contiguous CA EVM	10.4.0
09-2011	RP-53	RP-111266	935	Introduction of the downlink CA demodulation requirements	10.4.0
09-2011	RP-53	RP-111266	936r1	Introduction of CA UE demodulation requirements for TDD	10.4.0
12-2011	RP-54	RP-111684	947	Corrections of UE categories of Rel-10 reference channels for RF requirements	10.5.0
12-2011	RP-54	RP-111684	948	Alternative way to define channel bandwidths per operating band for	10.5.0
12-2011	RP-54	RP-111686	949	CR for TS36.101: Adding note to the function of MPR	10.5.0
12-2011	RP-54			Clarification on applying CSI reports during rank switching in RI	10.5.0
		RP-111680	950	FDD test - Rel-10	
12-2011	RP-54	RP-111734	953r1	Corrections for Band 42 and 43 introduction	10.5.0
12-2011	RP-54	RP-111680	956	UE spurious emissions	10.5.0
12-2011	RP-54	RP-111682	959	Add scrambling identity n_SCID for MU-MIMO test	10.5.0
12-2011	RP-54	RP-111690	960r1	P-MPR definition	10.5.0
12-2011	RP-54	RP-111693	962	Pcmax, c Computation Assumptions	10.5.0

12:2011         RP-54         RP-111890         965         Concentions of Re11 0 annotablists profiles         11:5           12:2011         RP-54         RP-111891         945         Concentions of Re11 0 annotablists profiles roles in CSI requirements         10:5           12:2011         RP-54         RP-111884         946         Concentions of LEI observation and the regulation of the regulation of the regulation of LEI observation of LEI observations of LEI observation of LEI observations of LEI observatios of LEI observations of LEI observatios of LEI observatios of L	12-2011	RP-54			Correction of frequency range for spurious emission	10.5.0
12:2011         RP-54         RP-111691         945         Corrections of Rel-10 demodulation performance requirements         10:5           12:2011         RP-54         RP-111694         946         Corrections of UE categories for Rel-10 CSI requirements         10:5           12:2011         RP-54         RP-111691         962:2         Introduction of SDR TO be state senario for CA UE demodulation         10:5           12:2011         RP-54         RP-111693         971:1         CR on Collidon of CA UE demodulation with CR 966         966           12:2011         RP-54         RP-111693         971:1         CR on Collidon of CG demodulation performance requirements         10:5           12:2011         RP-54         RP-111693         972:1         Introduction of SDR for case of 1C 2U Logabib UE         10:5           12:2011         RP-54         RP-111686         988         10)         Correction and maintenance on COI and PMI requirements (Rel-10:2011         RP-54         RP-111682         1005         Correction and maintenance on COI and PMI requirements (Rel-10:2011         RP-54         RP-111692         1006         Correction and maintenance on COI and PMI requirements (Rel-10:2011         RP-64         RP-111692         1007         Correction and maintenance requirements in 10:5         Correction and maintenance on COI and PMI requirements (Rel-10:2011         RP-64			RP-111733			
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12:2011         RP-54         RP-111884         946         Contraction of UE categories for Rel-10 CS1 equipments         10.5           12:2011         RP-54         RP-111691         9862         Thic R is only partially implemented due to confliction with CR           12:2011         RP-54         RP-111691         9872         Introduction of SDR TDD test scenario for CA UE demodulation The CR is only partially implemented due to confliction with CR           12:2011         RP-54         RP-111693         9721         Introduction of eICC demodulation performance requirements         10.5           12:2011         RP-54         RP-111694         986         Correction and maintenance on CCI and PMI requirements (Rel:         10.5           12:2011         RP-54         RP-111691         1005         CA demodulation performance requirements         10.5           12:2011         RP-54         RP-111692         1006         CA demodulation performance requirements (T E FDD 10.6         CA demodulation gendomance requirements (T E FDD 10.6         CA demodulation fisst (C D I and L M Mino fisst (C D I and L M Mino	12-2011	RP-54	RP-111691	945	This CR is only partially implemented due to confliction with CR	10.5.0
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12:2011         RP-54         RP-111693         9711         C R on Colliding CRS for non-MBSFN ABS         10.5           12:2011         RP-54         RP-111693         9721         Introduction of eCIC demodulation performance requirements for LTD and TDD         10.5           12:2011         RP-54         RP-111684         985         receiver requirements for case of 1 CC UL capable UE         10.5           12:2011         RP-54         RP-111684         986         10         10.5           12:2011         RP-54         RP-111684         1005         C Correction and maintenance on COI and PMI requirements for LTE FDD         10.5           12:2011         RP-54         RP-111692         1006         C Correporting accuracy test for TDD on COI and PMI requirements for LTE FDD         10.5           12:2011         RP-54         RP-111692         1007         on aDL MMO         10.5           12:2011         RP-54         RP-111692         10071         C CR for TS 36.101: Introduction of static COI INMO         10.5           12:2011         RP-54         RP-111692         10071         C R for TS 36.101: Introduction of static COI INMO         10.5           12:2011         RP-54         RP-111692         10071         C R for TS 36.101: Introduction of static COI INMO         10.5	12-2011	RP-54	RP-111691	982r2	Introduction of SDR TDD test scenario for CA UE demodulation This CR is only partially implemented due to confliction with CR	10.5.0
12-2011         RP-54 RP-111993         P2-rt P2-rt         Introduction of eICIC demodulation performance requirements 10:5 for FDD and TDD         10.5           12-2011         RP-54 RP-11168         BS         Adding missing UL configuration specification in some UE         10.5           12-2011         RP-54 RP-111684         98         Correction and maintenance on COI and PMI requirements (result Coll capable UE         10.5           12-2011         RP-54 RP-111694         998         Correction and maintenance on COI and PMI requirements (result FDD)         10.5           12-2011         RP-54 RP-54         RP-111692         1006         C.A demodulation performance requirements for LTE FDD         10.5           12-2011         RP-54 RP-511692         1006         C.A demodulation performance requirements for LTE FDD         10.5           12-2011         RP-54 RP-511692         1007         COI and the configuration sector the configurati	12-2011	PP-54	PP-111603	071r1		1050
12:2011         RP-54         Photom         Adding missing UL configuration specification is some UE         105.           12:2011         RP-54         RP-111686         985         Correction and maintenance on COI and PMI requirements (Rel         10.           12:2011         RP-54         RP-111691         1005         CCA demodulation parformance requirements for LTE PDD         10.5.           12:2011         RP-54         RP-111692         1006         CCA demodulation parformance requirements for LTE PDD         10.5.           12:2011         RP-54         RP-111692         1006         CCA demodulation parformance requirements for LTE PDD         10.5.           12:2011         RP-54         RP-111692         1007         CCI reporting accuracy test on frequency-selective scheduling         10.5.           12:2011         RP-54         RP-11692         10091         CCI reporting accuracy test for TDD an aDL MIMO         10.5.           12:2011         RP-54         RP-11692         10091         CCI reporting accuracy test for TDD an aDL MIMO         10.5.           12:2012         RP-56         RP-120300         10161         CP el/CIC ABS pattern         10.6.           03:2012         RP-55         RP-120301         10171         CP el/CIC ABS pattern         10.6.           03:2012 </td <td></td> <td></td> <td></td> <td></td> <td>Introduction of eICIC demodulation performance requirements</td> <td>10.5.0</td>					Introduction of eICIC demodulation performance requirements	10.5.0
RP-111634         998         10)           12:2011         RP-54         RP-111735         1004         MPR for CA Multi-cluster         10.5           12:2011         RP-54         RP-111691         1005         CA demodulation parformance requirements for LTE FDD         10.5           12:2011         RP-54         RP-111692         1006         CA reporting accuracy test for TDD on eDL MIMO         10.5           12:2011         RP-54         RP-111692         1006         PMI reporting accuracy test for TDD on eDL MIMO         10.5           12:2011         RP-54         RP-111692         1000r1         CR for TS 36.101: Introduction of static CQI tests (ReI-10)         10.5           12:2011         RP-54         RP-111692         1010r1         CR for TS 36.101: Introduction of static CQI tests (ReI-10)         10.5           03:2012         RP-55         RP-120300         1016r1         On eICC Interference models         10.6           03:2012         RP-55         RP-120300         1016r1         On eICC Interference models         10.6           03:2012         RP-55         RP-120300         1010r1         CR creston to MBMS Performance Test         10.6           03:2012         RP-55         RP-120300         1010r1         CR creston to MBMS Performance Teston to MBMS	12-2011	RP-54	RP-111686		Adding missing UL configuration specification in some UE	10.5.0
12.2011         RP-54         RP-111691         1005         CA demodulation performance requirements for LTE FDD         10.5           12.2011         RP-54         RP-111692         1006         COI reporting accuracy test on frequency on-selective scheduling on eDL MIMO         10.5           12.2011         RP-54         RP-111692         1008         PMI reporting accuracy test for TDD on eDL MIMO         10.5           12.2011         RP-54         RP-111692         1000r1         CR for TS 36.101: Introduction of static COI tests (ReI-10)         10.5           12.2011         RP-54         RP-111692         1010r1         CR for TS 36.101: Introduction of static COI tests (ReI-10)         10.5           0.32012         RP-55         RP-120300         1016r1         On eICIC INErference models         10.6           0.32012         RP-55         RP-120300         1016r1         On eICIC INErference models         10.6           0.32012         RP-55         RP-120300         1016r1         On eICIC INErference models         10.6           0.32012         RP-55         RP-120300         1016r1         On eICIC INErference models         10.6           0.32012         RP-55         RP-120301         102r1         TS36.01 CR: oneDL-MIMO channel model using cross-10.6           0.32012	12-2011	_		998	10)	10.5.0
12-2011         RP-54         RP-111692         1006         COI reporting accuracy test on frequency non-selective         10.5           12-2011         RP-54         RP-111692         1007         on eDL MMO         10.5           12-2011         RP-54         RP-111692         1008         PMI reporting accuracy test on frequency-selective scheduling         10.5           12-2011         RP-54         RP-111692         1009r1         CR for TS 36.101: Introduction of static Col tests (Re10)         10.5           12-2011         RP-54         RP-111692         1010r1         CR for TS 36.101: Introduction of static Col tests (Re10)         10.6           03-2012         RP-55         RP-120300         1016r1         On eICIC ABS pattern         10.6           03-2012         RP-55         RP-120300         1016r1         On eICIC Interference models         10.6           03-2012         RP-55         RP-120300         1016r1         On eICIC aBS pattern         10.6           03-2012         RP-55         RP-120300         1016r1         On eICIC aBS pattern         10.6           03-2012         RP-55         RP-120301         102r1         TS86.101 CR: onecl-MMO channel model using cross-         10.6           03-2012         RP-55         RP-120304 <td< td=""><td>12-2011</td><td></td><td></td><td></td><td></td><td>10.5.0</td></td<>	12-2011					10.5.0
RP-54         Scheduling on eDL MIMO         CCI reporting accuracy test on frequency-selective scheduling         10.5           12-2011         RP-54         RP-111692         1007         CCI reporting accuracy test on frequency-selective scheduling         10.5           12-2011         RP-54         RP-111692         10081         CR for TS 36.101: R1 performance requirements         10.5           12-2011         RP-54         RP-111692         10011         CR for TS 36.101: R1 performance requirements         10.5           03-2012         RP-55         RP-120291         1014         RF: Updates and corrections to the RMC-s related annexes (Rel-10.6         10.6           03-2012         RP-55         RP-120290         1017r1         Danized antennas         10.6           03-2012         RP-55         RP-120300         10211         TS36.101 CR: correction to MBMS Performance Test         10.6           03-2012         RP-55         RP-120303         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         104011         Correction of Actual code rate for CSI MCS         10.6           03-2012		-	RP-111691	1005		10.5.0
RP-111692         1007         on eDL MIMO         1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.			RP-111692	1006	scheduling on eDL MIMO	10.5.0
12-2011         RP-54         RP-111692         100rl         CR for TS 36.101: RI performance requirements         10.5           03-2012         RP-56         RP-110201         1010rl         CR for TS 36.101: Introduction of static COI tests (ReI-10)         10.5           03-2012         RP-56         RP-120201         1014         RF: Updates and corrections to the RMC-s related annexes (ReI-10)         10.6           03-2012         RP-55         RP-120209         10161         On eICIC ABS pattern         10.6           03-2012         RP-55         RP-120209         10171         TSS6.101 CR: on eDL-MIMO channel model using cross-10.6         10.6           03-2012         RP-55         RP-120304         102011         TSS6.101 CR: on eDL-MIMO channel model using cross-10.6         10.6           03-2012         RP-55         RP-120304         10211         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-56         RP-120304         1023         Unified titles for ReI-10 CSI tests         10.6           03-2012         RP-56         RP-120304         1040rl         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-56         RP-120304         1041rl         Definition of synchronized operation         10.6	-				on eDL MIMO	10.5.0
12-2011         RP-54         RP-111682         1010rl         CR for TS 36.101: Introduction of static COI tests (Rel-10)         10.5           03-2012         RP-56         RP-120201         1014         RF: Updates and corrections to the RMC-s related annexes (Rel-10)         10.6           03-2012         RP-55         RP-120300         1015r1         On elCIC ABS pattern         10.6           03-2012         RP-55         RP-120300         1015r1         On elCIC ABS pattern         10.6           03-2012         RP-55         RP-120300         1015r1         On elCIC ABS pattern         10.6           03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: Correction to MBMS Performance Test         10.6           03-2012         RP-55         RP-120304         10231         Unified tites for Rel-10 CS1 tests         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CS1 RMCS         10.6           03-2012         RP-55         RP-120304         1040r1         Definition of synchronized operation         10.6           03-2012         RP-56         RP-120294         1044r1         Intra band contiguos CA ue to Ue Co-ex         10.6           03-2012         RP-56         RP-120294						10.5.0
03-2012         RP-55         RP-120291         1014         RF: Updates and corrections to the RMC-s related annexes (Rel- 10)         10.6           03-2012         RP-55         RP-120300         1015r1         On elCiC ABS patterm         10.6           03-2012         RP-55         RP-120300         1015r1         On elCiC ABS patterm         10.6           03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: con eDL-MIMO channel model using cross- plarized antennas         10.6           03-2012         RP-55         RP-120303         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         1023         Unified titles for Rel-10 CSI tests         10.6           03-2012         RP-55         RP-120304         1023         Unified titles for Rel-10 CSI tests         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120304         1040r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120294         104r1         Definition of synchronized operation         10.6           03-2012         RP-55						10.5.0
03-2012         RP-55         RP-120300         1016r1         On eICic ABS pattern         106           03-2012         RP-55         RP-120300         1016r1         On eICic ABS pattern         106           03-2012         RP-55         RP-120309         1017r1         TS36.101 CR: on eDL-MIMO channel model using cross-polarized antennas         106           03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: Correction to MBMS Performance Test         10.6           03-2012         RP-55         RP-120303         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120301         1033r1         Introduction of reference channel for eICIC demodulation         106.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI MdS         10.6           03-2012         RP-55         RP-120296         1048r1         Intra bance contage CA Le to UE co-ex         10.6           03-2012         RP-55         RP-120296         1048r1         Retinition of synchronized oparation         10.6           03-2012         RP-55         RP-120296         1049r1         REt-10 CA specification editorial consistency         10.6           03-2012         RP						10.5.0
03-2012         RP-55         RP-120300         1016r1         On eICC interference models         10.6           03-2012         RP-55         RP-120299         1017r1         TS36.101 CR: correction to MBMS Performance Test         10.6           03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: correction to MBMS Performance Test         10.6           03-2012         RP-55         RP-120304         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120300         103311         Introduction of reference channel for eICC demodulation         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification with power imbalance         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification with power imbalance         10.6           03-2012         RP-55         RP-120296         1054         Requirement for CA demodulation with power imbalance         10.6				-	10)	
03-2012         RP-55         RP-120299         1017r1         TS36.101 CR: on eDL-MIMO channel model using cross- polarized antennas.         10.6           03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: Correction to MBMS Performance Test Parameters         10.6           03-2012         RP-55         RP-120304         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         1023         Unified titles for Rel-10 CSI tests         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120304         104tr1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contigues CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1048r1         REL-10 CA specification editoral consistency         10.6           03-2012         RP-55         RP-120298         1057         Updaring Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1059r1         CA demodulation performance requirements for Band 23         10.6 <tr< td=""><td></td><td></td><td>RP-120300</td><td></td><td>On elCIC ABS pattern</td><td></td></tr<>			RP-120300		On elCIC ABS pattern	
03-2012         RP-55         RP-120304         1020r1         TS36.101 CR: Correction to MBMS Performance Test Parameters         10.6           03-2012         RP-55         RP-120303         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         1023         Unified titles for ReI-10 CSI tests         10.6           03-2012         RP-55         RP-120304         1033r1         Introduction of reference channel for elCIC demodulation         10.6           03-2012         RP-55         RP-120304         1041r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intraduction of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contigues CA be to Ue Co-ex         10.6           03-2012         RP-55         RP-120298         1053         Beamforming model for TM9         10.6           03-2012         RP-55         RP-120298         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1055r         Updating Band 23 duples specifications         10.6           03-2012         RP-					TS36.101 CR: on eDL-MIMO channel model using cross-	10.6.0
03-2012         RP-55         RP-120303         1021         Harmonic exceptions in LTE UE to UE co-ex tests         10.6           03-2012         RP-55         RP-120304         1023         Unified titles for ReI-10 CSI tests         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120304         1041r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contigues CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contigues CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1048r1         Ret_10-0 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120298         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120294         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012 <t< td=""><td>03-2012</td><td>RP-55</td><td>RP-120304</td><td>1020r1</td><td>TS36.101 CR: Correction to MBMS Performance Test</td><td>10.6.0</td></t<>	03-2012	RP-55	RP-120304	1020r1	TS36.101 CR: Correction to MBMS Performance Test	10.6.0
03-2012         RP-55         RP-120304         1023         Unified titles for Re-10 CSI tests         10.6           03-2012         RP-55         RP-120300         1033r1         Introduction of reference channel for eICIC demodulation         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120296         1049r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120294         1058r1         Correcting UE Coexistence Requirements for LTE TDD         10.6           03-2012         RP-55         RP-120304         10671         Introduction of TMs demodulation performance requirements for LSE special cons Rel 10         10.6 <td>03-2012</td> <td>RP-55</td> <td>RP-120303</td> <td>1021</td> <td></td> <td>10.6.0</td>	03-2012	RP-55	RP-120303	1021		10.6.0
03-2012         RP-55         RP-120300         1033r1         Introduction of reference channel for eICIC demodulation         10.6           03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120304         1041r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contiguos CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120298         1053         Beamforming model for TM9         10.6           03-2012         RP-55         RP-120298         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for LTE TDD         10.6           03-2012         RP-55         RP-120304         106f1         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120304         106f1         TS36.101 RE for INTa-band contiguous CA         10.6           03-2012						10.6.0
03-2012         RP-55         RP-120304         1040r1         Correction of Actual code rate for CSI RMCs         10.6           03-2012         RP-55         RP-120304         1041r1         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band contiguos CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1048r1         Response         Response         10.6           03-2012         RP-55         RP-120296         1053         Beamforming model for TM9         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for Band 23         10.6           03-2012         RP-55         RP-120304         10611         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120304         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         R						10.6.0
03-2012         RP-55         RP-120304         104111         Definition of synchronized operation         10.6           03-2012         RP-55         RP-120296         1048r1         Intra band configuos CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1049r1         RE-L1 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1053         Beamforming model for TM9         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for LTE TDD         10.6           03-2012         RP-55         RP-120304         1067r1         Introduction of TM9 demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-5						10.6.0
03-2012         RP-55         RP-120296         1048r1         Intra band contiguos CA Ue to Ue Co-ex         10.6           03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for LTE TDD         10.6           03-2012         RP-55         RP-120293         1064r1         TS38.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120294         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120304         1077r1         CR for 38.101: B41 REFSENS and MOP changes to         10.6						10.6.0
03-2012         RP-55         RP-120296         1049r1         REL-10 CA specification editorial consistency         10.6           03-2012         RP-55         RP-120296         1053         Beamforming model for TM9         106           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120304         1061         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120294         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120294         1067r1         Introduction of a CA demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to         acchormodulation performance requirements <t< td=""><td></td><td></td><td></td><td></td><td></td><td>10.6.0</td></t<>						10.6.0
03-2012         RP-55         RP-120299         1053         Beamforming model for TM9         10.6           03-2012         RP-55         RP-120296         1054         Requirement for CA demodulation with power imbalance         10.6           03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120304         1061         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120294         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120296         1072         MPR formula correction For intra-band contiguous CA         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101 Set Set for eICC         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101 sets for US set S						10.6.0
03-2012         RP-55         RP-120298         1057         Updating Band 23 duplex specifications         10.6           03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for LTE TDD         10.6           03-2012         RP-55         RP-120304         1061         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of A CA demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer management testing         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         10821         TM3 tests for equirements of CQI reporting definition for eclCC         10.6           03-2012         RP-55         RP-120300         10821		RP-55				10.6.0
03-2012         RP-55         RP-120298         1058r1         Correcting UE Coexistence Requirements for Band 23         10.6           03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for LTE TDD         10.6           03-2012         RP-55         RP-120293         1064r1         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120299         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082r         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082r         TM3 tests for eICIC         10.6           03-2012 <td>03-2012</td> <td>RP-55</td> <td>RP-120296</td> <td>1054</td> <td></td> <td>10.6.0</td>	03-2012	RP-55	RP-120296	1054		10.6.0
03-2012         RP-55         RP-120304         1059r1         CA demodulation performance requirements for LTE TDD         10.6           03-2012         RP-55         RP-120304         1061         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120293         1064r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for elCIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for elCIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for elCIC         10.6           03-2012         RP-55         <	03-2012	RP-55	RP-120298	1057	Updating Band 23 duplex specifications	10.6.0
03-2012         RP-155         RP-120304         1061         Requirement for CA SDR FDD test scenario         10.6           03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120299         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120304         1071r1         MPR formula correction For intra-band contiguous CA         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eQIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eQIC         10.6           03-2012         RP-55         RP-120300         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120310         1074 <td>03-2012</td> <td>RP-55</td> <td>RP-120298</td> <td>1058r1</td> <td>Correcting UE Coexistence Requirements for Band 23</td> <td>10.6.0</td>	03-2012	RP-55	RP-120298	1058r1	Correcting UE Coexistence Requirements for Band 23	10.6.0
03-2012         RP-55         RP-120293         1064r1         TS36.101 RF editorial corrections Rel 10         10.6           03-2012         RP-55         RP-120299         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer         10.6           03-2012         RP-55         RP-120303         1077         MPR formula correction For intra-band contiguous CA Bandwidth Class C         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements of CQI reporting definition for eclCIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0      <	03-2012	RP-55	RP-120304	1059r1	CA demodulation performance requirements for LTE TDD	10.6.0
03-2012         RP-55         RP-120299         1067r1         Introduction of TM9 demodulation performance requirements         10.6           03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer management testing         10.6           03-2012         RP-55         RP-120296         1072         MPR formula correction For intra-band contiguous CA Bandwidth Class C         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for elCIC         10.6           03-2012         RP-55         RP-120300         1082         Introduction of requirements of CQI reporting definition for ecICIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 5	03-2012		RP-120304			10.6.0
03-2012         RP-55         RP-120304         1071r1         Introduction of a CA demodulation test for UE soft buffer management testing         10.6           03-2012         RP-55         RP-120296         1072         MPR formula correction For intra-band contiguous CA Bandwidth Class C         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         10821         Introduction of requirements of CQI reporting definition for ecICIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120310         107r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1      <	03-2012	RP-55	RP-120293	1064r1		10.6.0
03-2012         RP-55         RP-120296         1072         MPR formula correction For intra-band contiguous CA Bandwidth Class C         10.6           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1083r1         Introduction of requirements of CQI reporting definition for ecICIC         10.6           03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-56         RP-120791         1076         Band 41 CA CR for TS36.101, section 7         11.0           03-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1						10.6.0
Bandwidth Class C         Bandwidth Class C           03-2012         RP-55         RP-120303         1077r1         CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         TM3 tests for eICIC         10.6           03-2012         RP-55         RP-120300         1082         ECICIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements of CQI reporting definition for eciCIC         10.6           03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 7         11.0           03-2012         RP-56         RP-120370         1076         Band 41 CA CR for TS36.101, section 7         11.0           03-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11					management testing	10.6.0
OBS-2012RP-55RP-1203001082TM3 tests for elClC10.603-2012RP-55RP-1203001083r1Introduction of requirements of CQI reporting definition for eclClC10.603-2012RP-55RP-1203041084eDL MIMO CSI requirements10.603-2012RP-55RP-1203061070r1Introduction of Band 26/XXVI to TS 36.10111.003-2012RP-55RP-1203101074Band 41 CA CR for TS36.101, section 511.003-2012RP-55RP-1203101075r1Band 41 CA CR for TS36.101, section 611.003-2012RP-55RP-1203101076Band 41 CA CR for TS36.101, section 711.003-2012RP-56RP-1207951085r2Modulator specification tightening11.106-2012RP-56RP-1207771087r1Carrier aggregation Relative power tolerance, removal of TBD.11.106-2012RP-56RP-1207831089UE spurious emissions for Band 7 and Band 38 coexistence11.106-2012RP-56RP-1207791097CR to TS36.101: Correction on parameters for the eDL-MIMO11.106-2012RP-56RP-1207791097CR to TS36.101: Fixed reference channel for PDSCH11.1					Bandwidth Class C	
03-2012         RP-55         RP-120300         1083r1         Introduction of requirements of CQI reporting definition for eclCIC         10.6           03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-56         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           03-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120779         1092         Deleting square brackets in Reference Measurement Channels         11.1					accommodate single filter architecture	10.6.0
03-2012         RP-55         RP-120304         1084         eDL MIMO CSI requirements         10.6           03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           03-2012         RP-56         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56 </td <td></td> <td></td> <td></td> <td></td> <td>Introduction of requirements of CQI reporting definition for</td> <td>10.6.0</td>					Introduction of requirements of CQI reporting definition for	10.6.0
03-2012         RP-55         RP-120306         1070r1         Introduction of Band 26/XXVI to TS 36.101         11.0           03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-56         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO         CQI and PMI tests         11.1 </td <td>03-2012</td> <td>RP-55</td> <td>RP-120304</td> <td>1084</td> <td></td> <td>10.6.0</td>	03-2012	RP-55	RP-120304	1084		10.6.0
03-2012         RP-55         RP-120310         1074         Band 41 CA CR for TS36.101, section 5         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO         CQI and PMI tests         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Fixed reference channel for PDSCH <t< td=""><td></td><td></td><td></td><td></td><td></td><td>11.0.0</td></t<>						11.0.0
03-2012         RP-55         RP-120310         1075r1         Band 41 CA CR for TS36.101, section 6         11.0           03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Fixed reference channel for PDSCH         11.1						11.0.0
03-2012         RP-55         RP-120310         1076         Band 41 CA CR for TS36.101, section 7         11.0           06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Fixed reference channel for PDSCH         11.1					Band 41 CA CR for TS36.101, section 6	11.0.0
06-2012         RP-56         RP-120795         1085r2         Modulator specification tightening         11.1           06-2012         RP-56         RP-120777         1087r1         Carrier aggregation Relative power tolerance, removal of TBD.         11.1           06-2012         RP-56         RP-120783         1089         UE spurious emissions for Band 7 and Band 38 coexistence         11.1           06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Fixed reference channel for PDSCH         11.1	03-2012	RP-55	RP-120310	1076		11.0.0
06-2012RP-56RP-1207771087r1Carrier aggregation Relative power tolerance, removal of TBD.11.106-2012RP-56RP-1207831089UE spurious emissions for Band 7 and Band 38 coexistence11.106-2012RP-56RP-1207801092Deleting square brackets in Reference Measurement Channels11.106-2012RP-56RP-1207791097CR to TS36.101: Correction on parameters for the eDL-MIMO CQI and PMI tests11.106-2012RP-56RP-1207791097CR to TS36.101: Fixed reference channel for PDSCH					Modulator specification tightening	11.1.0
06-2012       RP-56       RP-120783       1089       UE spurious emissions for Band 7 and Band 38 coexistence       11.1         06-2012       RP-56       RP-120780       1092       Deleting square brackets in Reference Measurement Channels       11.1         06-2012       RP-56       RP-120779       1097       CR to TS36.101: Correction on parameters for the eDL-MIMO CQI and PMI tests       11.1         06-2012       RP-56       RP-120779       1097       CR to TS36.101: Fixed reference channel for PDSCH       11.1	06-2012	RP-56	RP-120777			11.1.0
06-2012         RP-56         RP-120780         1092         Deleting square brackets in Reference Measurement Channels         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO CQI and PMI tests         11.1           06-2012         RP-56         RP-120779         1097         CR to TS36.101: Fixed reference channel for PDSCH         11.1						11.1.0
06-2012         RP-56         RP-120779         1097         CR to TS36.101: Correction on parameters for the eDL-MIMO CQI and PMI tests         11.1           CR to TS36.101: Fixed reference channel for PDSCH         CR to TS36.101: Fixed reference channel for PDSCH         11.1				1092		11.1.0
		RP-56		1097	CR to TS36.101: Correction on parameters for the eDL-MIMO CQI and PMI tests	11.1.0
	00.001-	DD		1000	demodulation performance requirements on eDL-MIMO – NOT	11.1.0

06-2012	RP-56	RP-120774	1107	RMC correction on eDL-MIMO RI test	11.1.0
06-2012	RP-56	RP-120774	1108r1	FRC correction on frequency selective CQI and PMI test (Rel-	11.1.0
				11)	-
06-2012	RP-56	RP-120774	1111	Correction on test point for PMI test (Rel-11)	11.1.0
06-2012	RP-56	RP-120784	1114r1	Corrections and clarifications on eICIC demodulation test	11.1.0
06-2012	RP-56	RP-120784	1117r1	Corrections and clarifications on elCIC CSI tests	11.1.0
06-2012	RP-56	RP-120783 RP-120773	1119r1 1120	Corrections on UE performance requirements Introduction of CA band combination Band1 + Band19 to TS	11.1.0
06-2012	RP-56	RP-120773	1120	36.101	11.1.0
06-2012	RP-56	RP-120769	1127	Addition of ETU30 channel model	11.1.0
06-2012	RP-56	RP-120773	1140	Addition of Maximum Throughput for R.30-1 TDD RMC	11.1.0
06-2012	RP-56	RP-120779	1141	CR for 36.101: The clarification of MPR and A-MPR for CA	11.1.0
06-2012	RP-56	RP-120784	1142	Corrections for eICIC demod test case with MBSN ABS	11.1.0
06-2012	RP-56	RP-120785	1144	Removing brackets of contiguous allocation A-MPR for	11.1.0
				CA_NS_04	
06-2012	RP-56	RP-120784	1149r1	Introduction of PDCCH test with colliding RS on MBSFN-ABS	11.1.0
06-2012	RP-56	RP-120784	1153r1	Some clarifications and OCNG pattern for eICIC demodulation requirements	11.1.0
06-2012	RP-56	RP-120773	1155	Introduction of TDD CA Soft Buffer Limitation	11.1.0
06-2012	RP-56	RP-120795	1156	B26 and other editorial corrections	11.1.0
06-2012	RP-56	RP-120779	1161	Corrections on CQI and PMI test	11.1.0
06-2012	RP-56	RP-120780	1163	FRC for TDD PMI test	11.1.0
06-2012	RP-56	RP-120778	1165r1	Clean-up of UL-MIMO for TS36.101	11.1.0
06-2012	RP-56	RP-120782	1171	Removal of unnecessary references to single carrier	11.1.0
				requirements from Interband CA subclauses	
06-2012	RP-56	RP-120781	1174	PDCCH wrong detection in receiver spurious emissions test	11.1.0
06-2012	RP-56	RP-120776	1184	Corrections to 3500 MHz	11.1.0
06-2012	RP-56	RP-120793	1189r2	Introduction of Band 44	11.1.0
06-2012	RP-56	RP-120784	1193r1	Target SNR setting for eICIC demodulation requirement	11.1.0
06-2012	RP-56	RP-120780	1196	Editorial simplification to CA REFSENS UL allocation table	11.1.0
06-2012	RP-56	RP-120778 RP-120791	1199 1200r1	Correction of wrong table references in CA receiver tests Introduction of e850_LB (Band 27) to TS 36.101	11.1.0
06-2012 06-2012	RP-56 RP-56	RP-120791 RP-120764	120011	Correction of PHS protection requirements for TS 36.101	11.1.0 11.1.0
06-2012	RP-56	RP-120793	1212 1213r1	Introduction of Band 28 into TS36.101	11.1.0
06-2012	RP-56	RP-120781	1215r1	Proposed revision of subclause 4.3A for TS36.101	11.1.0
06-2012	RP-56	RP-120781	1217r1	Proposed revision of subclause 4.3.4 for TS36.101	11.1.0
06-2012	RP-56	RP-120795	1219r1	Aligning requirements between Band 18 and Band 26 in	11.1.0
				TS36.101	
06-2012	RP-56	RP-120782	1221	SNR definition	11.1.0
06-2012	RP-56	RP-120778	1223	Correction of CSI configuration for CA TM4 tests R11	11.1.0
06-2012	RP-56	RP-120773	1225	CR on CA UE receiver timing window R11	11.1.0
06-2012	RP-56	RP-120784	1226	Extension of static eICIC CQI test	11.1.0
09-2012	RP-57	RP-121294	1230	Correct Transport Block size in 9RB 16QAM Uplink Reference	11.2.0
00.0010	DD 57	DD 404040	4000-4	Measurement Channel	11.0.0
09-2012	RP-57	RP-121313	1233r1	RF: Corrections to power allocation parameters for transmission	11.2.0
09-2012	RP-57	RP-121304	1235	mode 8 (Rel-11) RF-CA: non-CA notation and applicability of test points in	11.2.0
09-2012	NF-37	KF-121304	1255	scenarios without and with CA operation (Rel-11)	11.2.0
09-2012	RP-57	RP-121305	1237	ACK/NACK feedback modes for FDD and TDD TM4 CA	11.2.0
00 2012		1		demodulation requirements (Rel-11)	
09-2012	RP-57	RP-121305	1239	Correction of feedback mode for CA TDD demodulation	11.2.0
				requirements (resubmission of R4-63AH-0194 for Rel-11)	
09-2012	RP-57	RP-121302	1241	ABS pattern setup for MBSFN ABS test (resubmission of R4-	11.2.0
				63AH-0204 for Rel-11)	
09-2012	RP-57	RP-121302	1243	CR on eICIC CQI definition test (resubmission of R4-63AH-0205	11.2.0
00.0040		DD 404000	1245	for Rel-11)	11.0.0
09-2012 09-2012	RP-57 RP-57	RP-121302 RP-121302	1245 1247	Transmission of CQI feedback and other corrections (Rel-11)	11.2.0 11.2.0
09-2012	rr-3/	RF-121302	1247	Target SNR setting for eICIC MBSFN-ABS demodulation requirements (Rel-11)	11.2.0
09-2012	RP-57	RP-121335	1248	Introduction of CA_1_21 RF requirements into TS36.101	11.2.0
09-2012	RP-57	RP-121333	1240	Corrections of spurious emission band UE co-existence	11.2.0
50 <u>-</u> 51 <u>-</u>				applicable in Japan	
09-2012	RP-57	RP-121306	1253	Correction on RMC for frequency non-selective CQI test	11.2.0
	RP-57	RP-121306	1255	Requirements for the eDL-MIMO CQI test	11.2.0
09-2012		RP-121302	1257	Clarification on PDSCH test setup under MBSFN ABS	11.2.0
09-2012	RP-57			Update of Band 28 requirements	11.2.0
09-2012 09-2012	RP-57	RP-121316	1258	opdate of Band 20 requirements	
09-2012 09-2012 09-2012	RP-57 RP-57	RP-121316 RP-121313	1262	Applicability of statement allowing RBW < Meas BW for spurious	11.2.0
09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57	RP-121316 RP-121313 RP-121298	1262 1265	Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests	11.2.0
09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57	RP-121316RP-121313RP-121298RP-121304	1262           1265           1267	Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests Removal of brackets for CA Tx	11.2.0 11.2.0
09-2012 09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57 RP-57	RP-121316 RP-121313 RP-121298 RP-121304 RP-121337	1262           1265           1267           1268r1	Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests Removal of brackets for CA Tx TS 36.101 CR for CA_38	11.2.0 11.2.0 11.2.0
09-2012 09-2012 09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57 RP-57 RP-57	RP-121316 RP-121313 RP-121298 RP-121304 RP-121337 RP-121327	1262           1265           1267           1268r1           1269	Applicability of statement allowing RBW < Meas BW for spurious	11.2.0 11.2.0 11.2.0 11.2.0
09-2012 09-2012 09-2012 09-2012 09-2012 09-2012	RP-57 RP-57 RP-57 RP-57 RP-57	RP-121316 RP-121313 RP-121298 RP-121304 RP-121337	1262           1265           1267           1268r1	Applicability of statement allowing RBW < Meas BW for spurious Clarification of RB allocation for DRS demodulation tests Removal of brackets for CA Tx TS 36.101 CR for CA_38	11.2.0 11.2.0 11.2.0

09-2012	RP-57	RP-121307	1276	Correction of eDL-MIMIO CSI RMC tables and references	11.2.0
09-2012	RP-57	RP-121307	1278	Correction of MIMO channel model for polarized antennas	11.2.0
09-2012	RP-57	RP-121303	1280	Addition of 15 and 20MHz Bandwidths for Band 23 to TS 36.101 (Rel-11)	11.2.0
09-2012	RP-57	RP-121334	1283r1	Add requirements for inter-band CA of B_1-18 and B_11-18 in TS36.101	11.2.0
09-2012	RP-57	RP-121304	1285r1	CR for MPR mask for multi-clustered simultaneous transmission in single CC in Rel-11	11.2.0
09-2012	RP-57	RP-121447	1288r2	Introduction of Japanese Regulatory Requirements to LTE Band 8(R11)	11.2.0
09-2012	RP-57	RP-121315	1289	CR for Band 27 MOP	11.2.0
09-2012	RP-57	RP-121315	1290	CR for Band 27 A-MPR	11.2.0
09-2012	RP-57	RP-121316	1291	CR to replace protected frequency range with new band number	11.2.0
09-2012	RP-57	RP-121215	1292r1	27 Introduction of CA band combination Band3 + Band5 to TS	11.2.0
				36.101	
09-2012	RP-57	RP-121306	1300r1	Requirements for eDL-MIMO RI test	11.2.0
09-2012	RP-57	RP-121306	1304	Corrections to TM9 demodulation tests	11.2.0
09-2012	RP-57	RP-121313	1306	Correction to PCFICH power parameter setting	11.2.0
09-2012	RP-57	RP-121306	1310r1	Correction on frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1313r1	eDL-MIMO CQI/PMI test	11.2.0
09-2012	RP-57	RP-121313	1316	Correction of the definition of unsynchronized operation	11.2.0
09-2012	RP-57	RP-121304	1320r1	Correction to Transmit Modulation Quality Tests for Intra-Band CA	11.2.0
09-2012	RP-57	RP-121338	1324r2	36.101 CR for LTE_CA_B7	11.2.0
09-2012	RP-57	RP-121331	1325	Introduction of CA_3_20 RF requirements into TS36.101	11.2.0
09-2012	RP-57	RP-121316	1326	A-MPR table correction for NS_18	11.2.0
09-2012	RP-57	RP-121304	1332r1	Bandwidth combination sets for intra-band and inter-band carrier aggregation	11.2.0
09-2012	RP-57	RP-121325	1339	Introduction of LTE Advanced Carrier Aggregation of Band 4 and Band 13	11.2.0
09-2012	RP-57	RP-121326	1340r1	Introduction of CA configurations CA-12A-4A and CA-17A-4A	11.2.0
09-2012	RP-57	RP-121324	1341	Introduction of CA_B3_B7 in 36.101	11.2.0
09-2012	RP-57	RP-121328	1343	Introduction of Band 2 + Band 17 inter-band CA configuration into 36.101	11.2.0
09-2012	RP-57	RP-121306	1351	FRC for TM9 FDD	11.2.0
09-2012	RP-57	RP-121295	1352	Random precoding granularity in PMI tests	11.2.0
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06-2014	RP-64	RP-140914	2214r1	Correction of UE TM3 demodulation performance requirements	11.9.0
06-2014	RP-64	RP-140917	2215r1	CR for EPDCCH test (Rel-11)	11.9.0
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12-2014	RP-66	RP-142144	2709r1	Clarification of UL and DL CA configuration	11.11.0
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03-2015	RP-67 RP-67	RP-150382 RP-150381	2821	Corrections to CA in-band emissions requirement	11.12.0
03-2015		1 00 16/0201	2829	Uplink RMCs for sustained data rate test	11.12.0

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07-2015	RP-68	RP-150955	2995r1		Correction to CA_7C A-MPR in CA-NS_06	11.13.0
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07-2015	RP-68	RP-150954	3013r1		Clarification on uplink configuration for reference sensitivity of inter-band CA. – NOT implemented as it is based on a wrong version of the spec	11.13.0
09-2015	RP-69	RP-151476	3034		Correction to CoMP demodulation requirements	11.14.0
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09-2015	RP-69	RP-151483	3048		UE co-existence requirements between Band 42 and Japanese bands	11.14.0
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