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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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Where:

- x the first digit:
  - 1 presented to TSG for information;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- 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 (affract)	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 <i>lowest carrier</i> , 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
$F_{DL_high}$ $F_{UL_low}$	The highest frequency of the downlink operating band The lowest frequency of the uplink operating band
F <sub>UL_high</sub>	The highest frequency of the uplink operating band
F <sub>edge,block,low</sub>	The lower sub-block edge, where $F_{edge,block,low} = F_{C,block,low} - F_{offset}$ .
F <sub>edge,block,high</sub>	The upper sub-block edge, where $F_{edge,block,high} = F_{C,block,high} + F_{offset}$ .
$F_{edge_{low}}$	The lower edge of aggregated channel bandwidth, expressed in MHz.
F <sub>edge_high</sub>	The <i>higher edge</i> 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> . Separation between lower edge of a sub-block and the center of the lowest component carrier
Foffset, block, low	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 Downlink EARFCN
N <sub>DL</sub>	
$N_{oc}$	The power spectral density of a white noise source (average power per RE normalised to the
N	subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector The power spectral density of a white noise source (average power per RE normalized to the
N <sub>oc1</sub>	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 <sub>oc2</sub>	The power spectral density of a white noise source (average power per RE normalized to the 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.
$N_{oc3}$	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> N <sub>Offs-UL</sub>	Offset used for calculating downlink EARFCN 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
$N_{RB_{agg}}$	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 Channel Bandwidth.
N <sub>RB,c</sub>	The transmission bandwidth configuration of component carrier $c$ , expressed in units of resource
NT	blocks
N <sub>RB,largest BW</sub>	The largest transmission bandwidth configuration of the component carriers in the bandwidth
N <sub>UL</sub>	combination, expressed in units of resource blocks 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 <i>c</i> . 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 Indicates the lowest RB index of transmitted resource blocks.
$RB_{start}$ $RB_{end}$	Indicates the highest RB index of transmitted resource blocks.
$\Delta f_{OOB}$	$\Delta$ Frequency of Out Of Band emission.
$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell <i>c</i> .
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell <i>c</i> .
$\Delta T_{C}$	Allowed operating band edge transmission power relaxation.
$\Delta T_{C,c}$	Allowed operating band edge transmission power relaxation for serving cell <i>c</i> .
$ ho_{\scriptscriptstyle A}$	According to Clause 5.2 in TS 36.213 [6]
$ ho_{\scriptscriptstyle B}$	According to Clause 5.2 in TS 36.213 [6]
σ	Test specific auxiliary variable used for the purpose of downlink power allocation, defined in Annex C.3.2.
$\mathbf{W}_{\mathrm{gap}}$	Sub-block gap size

# 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 DA	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	User Equipment
UL	Uplink
UL-MIMO	Up Link Multiple Antenna transmission
UMTS	Universal Mobile Telecommunications System
UTRA	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 cell-
	specific RS
xCH_RB	xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols containing cell-
_	specific RS

# 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) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode	
	F <sub>UL_low</sub> – F <sub>UL_high</sub>	$F_{DL_{low}} - F_{DL_{high}}$		
1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD	
2	1850 MHz – 1910 MHz	1930 MHz – 1990 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 – 885 MHz	FDD	
7	2500 MHz – 2570 MHz	2620 MHz – 2690 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	
11	1427.9 MHz – 1447.9 MHz	1475.9 MHz – 1495.9 MHz	FDD	
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD	
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD	
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD	
15	Reserved	Reserved	FDD	
16	Reserved	Reserved	FDD	
17	704 MHz – 716 MHz	734 MHz – 746 MHz	FDD	
18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD	
19	830 MHz – 845 MHz	875 MHz – 890 MHz	FDD	
20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD	
21	1447.9 MHz – 1462.9 MHz	1495.9 MHz – 1510.9 MHz	FDD	
22	3410 MHz – 3490 MHz	3510 MHz – 3590 MHz	FDD	
23	2000 MHz – 2020 MHz	2180 MHz – 2200 MHz	FDD	
24	1626.5 MHz – 1660.5 MHz	1525 MHz – 1559 MHz	FDD	
25	1850 MHz – 1915 MHz	1930 MHz – 1995 MHz	FDD	
26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD	
27	807 MHz – 824 MHz	852 MHz – 869 MHz	FDD	
28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD	
20	N/A	717 MHz – 728 MHz	FDD <sup>2</sup>	
	IN/A		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 – 1910 MHz	TDD	
36	1930 MHz – 1990 MHz	1930 MHz – 1990 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	
40	2496 MHz 2690 MHz	2496 MHz 2690 MHz	TDD	
41			TDD	
43	3600 MHz – 3800 MHz	3600 MHz - 3800 MHz	TDD	
44	703 MHz – 803 MHz	703 MHz – 803 MHz	TDD	
NOTE 2: R d	ownlink operating band is paired w	en carrier aggregation is configured. Ith the uplink operating band (externation to the ternation of the configured Pcell.		

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
CA Band	Band	BS receive / UE transmit			BS transmit / UE receive			Mode
		$F_{UL_{low}} - F_{UL_{high}}$			F <sub>DL_lo</sub>	w -	$F_{DL_high}$	
CA_1	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
CA_7	7	2500 MHz	-	2570 MHz	2620 MHz	I	2690 MHz	FDD
CA_38	38	2570 MHz	_	2620 MHz	2570 MHz	١	2620 MHz	TDD
CA_40	40	2300 MHz	_	2400 MHz	2300 MHz	I	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 CA Band	E-UTRA Band			rating band			perating band	Duplex
СА Бапо	Бапа	BS receive / UE transmit FuL_low - FuL_high		BS transmit / UE receive F <sub>DL_low</sub> – F <sub>DL_high</sub>			Mode	
			<u> </u>			w —		
CA_1-5	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
_	5	824 MHz	-	849 MHz	869 MHz	-	894 MHz	
CA_1-18	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
<u>-</u>	18	815 MHz	-	830 MHz	860 MHz	-	875 MHz	
CA_1-19	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
0	19	830 MHz	-	845 MHz	875 MHz	-	890 MHz	
CA_1-21	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD
0,(_12)	21	1447.9 MHz	-	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	
CA_2-17	2	1850 MHz	-	1910 MHz	1930 MHz	-	1990 MHz	FDD
0/(_2 1/	17	704 MHz	-	716 MHz	734 MHz	-	746 MHz	100
CA_2-29	2	1850 MHz	-	1910 MHz	1930 MHz	-	1990 MHz	FDD
07_2-23	29		N/A		717 MHz	-	728 MHz	100
CA_3-5	3	1710 MHz	-	1785 MHz	1805 MHz	-	1880 MHz	FDD
CA_3-5	5	824 MHz	-	849 MHz	869 MHz	Ι	894 MHz	FDD
CA 27	3	1710 MHz	-	1785 MHz	1805 MHz	-	1880 MHz	
CA_3-7	7	2500 MHz	-	2570 MHz	2620 MHz	Ι	2690 MHz	FDD
	3	1710 MHz		1785 MHz	1805 MHz		1880 MHz	500
CA_3-8	8	880 MHz		915 MHz	925 MHz		960 MHz	FDD
CA_3-20	3	1710 MHz	_	1785 MHz	1805 MHz	-	1880 MHz	
	20	832 MHz	-	862 MHz	791 MHz	_	821 MHz	FDD
	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-5	5	824 MHz	-	849 MHz	869 MHz	-	894 MHz	
	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	
CA_4-7	7	2500 MHz		2570 MHz	2620 MHz		2690 MHz	FDD
	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-17	17	704 MHz		716 MHz	734 MHz		746 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz		2155 MHz	
CA_4-29	29		N/A		717 MHz		728 MHz	FDD
	5	824 MHz		849 MHz	869 MHz		894 MHz	
CA_5-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
		824 MHz		849 MHz	869 MHz	_	894 MHz	
CA_5-17	5 17	704 MHz	-	716 MHz	734 MHz	_	746 MHz	FDD
	7		-		2620 MHz	_		
CA_7-20		2500 MHz	-	2570 MHz		-	2690 MHz	FDD
	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	
CA_8-20	8	880 MHz	-	915 MHz	925 MHz	-	960 MHz	FDD
	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	
CA_11-18	11	1427.9 MHz	-	1447.9 MHz	1475.9 MHz	-	1495.9 MHz	FDD
	18	815 MHz	-	830 MHz	860 MHz	-	875 MHz	1

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

E-UTRA	E-UTRA	Uplink (UL) operating band BS receive / UE transmit			Downlink (DL) operating band BS transmit / UE receive			Duplex
CA Band	Band							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

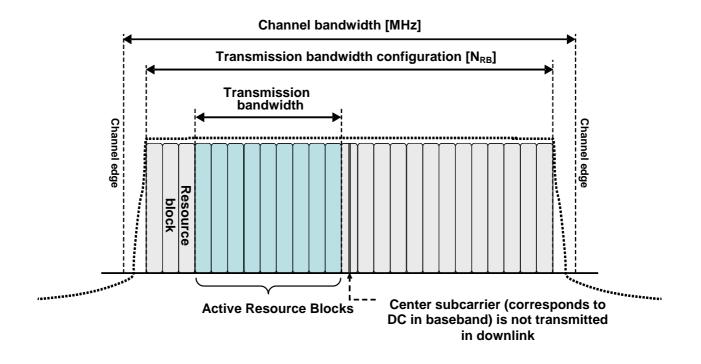
# 5.6 Channel bandwidth

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	l bandwidth				
E-UTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Band								
1			Yes	Yes	Yes	Yes		
2	Yes	Yes	Yes	Yes	Yes	Yes		
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>	2	1.2		
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>	100		
22			Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>		
23	Yes	Yes	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>		
23	163	163	Yes	Yes	163	163		
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>	103		
27	Yes	Yes	Yes	Yes <sup>1</sup>	103			
28	103	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes <sup>1, 2</sup>		
		105	103	103	100	103		
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 1:	refers to the			elaxation of th				
	sensitivity rec				·			
NOTE 2: 2				, num requirem	nents are spe	ecified for		
				ed to either 7				
738 MHz								
NOTE 3:				uplink transm				
	be restricted	by the netwo	ork for some	channel assig	nments in F	DD/TDD		
			order to mee	et unwanted e	emissions re	quirements		
	(Clause 6.6.3	8.2).						

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.

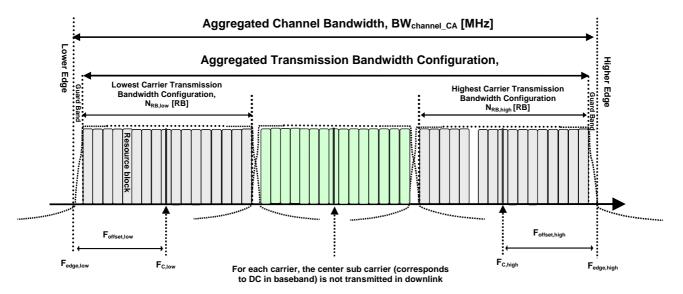


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

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.

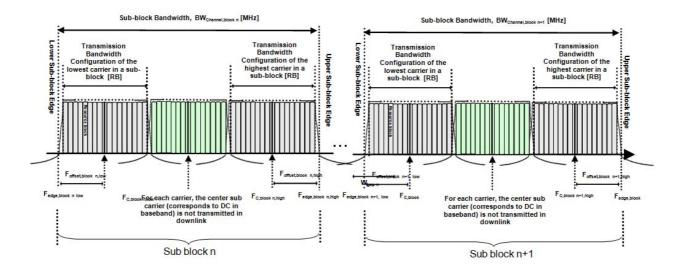


Figure 5.6A-2. Non-contiguous intraband CA terms and definitions

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

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

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	th Aggregated Maximum Transmission number of CC Bandwidth Configuration		Nominal Guard Band BW <sub>GB</sub>					
A	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	ling to Table 5.6-1 and $\Delta f_1$	= $\Delta f$ for the downli	nk with $\Delta f$ the subcarrier spacing while $\Delta f_1 =$					
0 for th	0 for the uplink.							
NOTE 2: a <sub>1</sub> = 0.	16/1.4 for BW <sub>Channel(1)</sub> = 1.4	MHz whereas a1	= 0.05 for all other channel bandwidths.					
NOTE 3: Applic	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								
		Component carriers in c freq	Maximum	Bandwidth combination set				
E-UTRA CA configuration	Uplink CA configurations (NOTE 3)	Channel bandwidths for carrier [MHz] Channel bandwidths for carrier [MHz]			aggregated bandwidth [MHz]			
CA_1C	CA_1C	15	15	40	0			
		20	20	40	0			
CA_7C	CA_7C	15	15	40	0			
		20	20	40	U			
CA 28C	CA_38C	15	15	40	0			
CA_38C		20	20	40	0			
		10	20					
CA_40C	CA_40C	15	15	40	0			
		20	10, 20					
		10	20					
CA_41C	CA_41C	15	15, 20	40	0			
		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 combination set
CA_1A-5A	-	1 5				Yes Yes			- 20	0
		1			Yes	Yes	Yes	Yes		<u>+</u>
CA_1A-18A	-	18			Yes	Yes	Yes	100	- 35	0
00.40.400		1			Yes	Yes	Yes	Yes	- 35	0
CA_1A-19A	-	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
UA_2A-17A		17			Yes	Yes				
CA_2A-29A	-	2		X	Yes	Yes			- 20	0
		29		Yes	Yes	Yes	Vaa	Vee		
		3 5			Yes	Yes Yes	Yes	Yes	- 30	0 1 0
CA_3A-5A	-	3			165	Yes				
		5			Yes	Yes			20	
		3			Yes	Yes	Yes	Yes		
CA_3A-7A	-	7			100	Yes	Yes	Yes	40	
		3				Yes	Yes	Yes		
		8			Yes	Yes			- 30	0
CA_3A-8A	-	3				Yes			- 20	1
		8			Yes	Yes				
	-	3			Yes	Yes	Yes	Yes	- 30	0
CA_3A-20A		20			Yes	Yes				
CA_4A-5A	_	4			Yes	Yes			- 20	0
07_47-37	-	5			Yes	Yes				
CA_4A-7A	-	4			Yes	Yes			- 30	0
0		7			Yes	Yes	Yes	Yes		
CA_4A-12A	-	4	Yes	Yes	Yes	Yes			- 20	0
		12 <sup>5</sup>		-	Yes	Yes	Vee	N		
	-	4			Yes	Yes	Yes	Yes	- 30	0
CA_4A-13A		13 4			Yes	Yes Yes				
		13			165	Yes			- 20	
CA_4A-17A	-	4		1	Yes	Yes			- 20	0
		17 <sup>5</sup>			Yes	Yes				
0.4	-	4			Yes	Yes			- 20	0
CA_4A-29A		29		Yes	Yes	Yes	ĺ			
	-	5			Yes	Yes			20	0
CA_5A -12A		12		1	Yes	Yes				
CA_5A-17A		5			Yes	Yes			- 20	0
	-	17			Yes	Yes				
CA_7A-20A	-	7				Yes	Yes	Yes	- 30	0
		20			Yes	Yes				
CA_8A-20A	-	8			Yes	Yes			20	0
5, _ 5, 7 20, 7		20		ļ	Yes	Yes				
CA_11A-18A	- Configuration refer	11			Yes	Yes			25	0
		18		1	Yes	Yes	Yes			

#### 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			arriers in order of arrier frequency			
	Uplink CA configurations (NOTE 1)	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Maximum aggregated bandwidth [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)	$N_{Offs-DL}$	Range of N <sub>DL</sub>	F <sub>UL_low</sub> (MHz)	N <sub>Offs-UL</sub>	Range of NUL	
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 - 2039	
5	869	2400	2400 - 2649	824	20400	20400 - 2064	
6	875	2650	2650 - 2749	830	20650	20650 - 2074	
7	2620	2750	2750 - 3449	2500	20750	20750 - 2144	
8	925	3450	3450 - 3799	880	21450	21450 - 2179	
9	1844.9	3800	3800 - 4149	1749.9	21800	21800 - 22149	
10	2110	4150	4150 - 4749	1710	22150	22150 - 2274	
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 - 2327	
14	758	5280	5280 - 5379	788	23280	23280 - 2337	
17	734	5730	5730 - 5849	704	23730	23730 - 2384	
18	860	5850	5850 - 5999	815	23850	23850 - 2399	
19	875	6000	6000 - 6149	830	24000	24000 - 2414	
20	791	6150	6150 - 6449	832	24150	24150 - 2444	
21	1495.9	6450	6450 - 6599	1447.9	24450	24450 - 2459	
22	3510	6600	6600 - 7399	3410	24600	24600 - 2539	
23	2180	7500	7500 - 7699	2000	25500	25500 - 2569	
24	1525	7700	7700 - 8039	1626.5	25700	25700 - 2603	
25	1930	8040	8040 - 8689	1850	26040	26040 - 2668	
26	859	8690	8690 - 9039	814	26690	26690 - 2703	
27	852	9040	9040 - 9209	807	27040	27040 - 2720	
28	758	9210	9210 - 9659	703	27210	27210 - 2765	
29 <sup>2</sup>	717	9660	9660 - 9769		N/A	1	
33	1900	36000	36000 – 36199	1900	36000	36000 - 3619	
34	2010	36200	36200 - 36349	2010	36200	36200 - 3634	
35	1850	36350	36350 - 36949	1850	36350	36350 - 3694	
36	1930	36950	36950 - 37549	1930	36950	36950 - 3754	
37	1930	37550	37550 - 37749	1910	37550	37550 - 3774	
38	2570	37750	37750 – 38249	2570	37750	37750 - 3824	
39	1880	38250	38250 - 38649	1880	38250	38250 - 3864	
40	2300	38650	38650 - 39649	2300	38650	38650 - 3964	
41	2496	39650	39650 - 41589	2496	39650	39650 -41589	
42	3400	41590	41590 - 43589	3400	41590	41590 - 4358	
43	3600	43590	43590 - 45589	3600	43590	43590 - 45589	
44	703	45590	45590 - 46589	703	45590	45590 - 4658	
с 7 с	arrier extends bey 5 and 100 channe	ond the operated al numbers at the upper op	ate carrier frequenci ting band edge shall he lower operating ba erating band edge sh	not be used. This in and edge and the la	nplies that the fi st 6, 14, 24, 49	irst 7, 15, 25, 50, , 74 and 99	
			vhen carrier aggrega	tion is configured			

#### Table 5.7.3-1: E-UTRA channel numbers

NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured.

# 5.7.4 TX–RX frequency separation

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		
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			
7					23	$\frac{\pm 2}{\pm 2^2}$		
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		
	01	12/0			20	<u></u>		
17	1			1	23	<u>+2</u>	1	
18					23	±2 <sup>5</sup>		
19					23	±2		
20					23	$\pm 2^2$		
20					23	<u>+2</u>		
22					23	$+2/-3.5^{2}$		
23					23°	±2 <sup>6</sup>		
23					23			
24					23	$\frac{\pm 2}{\pm 2^2}$		
						$\pm 2$ $\pm 2^2$		
26 27					23 23	±2 ±2		
28					23	+2/-2.5		
						.0		
33					23	±2		
34					23	<u>+2</u>		
35					23	±2		
36					23	<u>+2</u>		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	$\pm 2$ $\pm 2^2$		
41					23			
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
NOTE 1: NOTE 2:	$^{2}$ refers to the F <sub>UL_high</sub> – 4	ne transmissio MHz and F <sub>UL_r</sub> mit by 1.5 dB	n bandwidth <sub>iigh</sub> , the maxi	s (Figure 5.6- mum output p	1) confined ower require	within F <sub>UL_low</sub> ar ement is relaxe	nd F <sub>UL_low</sub> + 4 d by reducing	MHz or g the lower
NOTE 4:	For the UE P <sub>PowerClass</sub> is For a UE th	which supports the maximum at supports bo	UE power s th Band 18	specified witho and Band 26,	out taking in the maximu	g frequencies, t to account the t m output power ndwidths confin	olerance requirement	t is relaxed by
NOTE 6:	818 MHz.		-			005 MHz shall b		

Table 6.2.2-1: UE Power Class

# 6.2.2A UE maximum output power for CA

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/-22		
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 <sub>UL_low</sub> + 4 MHz or/and F <sub>UL_high</sub> – 4 MHz and F <sub>UL_high</sub> , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB								
<ul> <li>NOTE 3: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance</li> <li>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).</li> </ul>								

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).

1 2 3			(dBm)	(dB)	(dBm)	(dB)	(dBm)	(dB)
					23	+2/-3		
3					23	$+2/-3^{2}$		
					23	+2/-32		
4					23	+2/-3		
5					23	+2/-3		
6					23	+2/-3		
7					23	$+2/-3^{2}$		
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		
17					23	+2/-3		
18					23	+2/-3		
19					23	+2/-3		
20					23	$+2/-3^{2}$		
21					23	+2/-3		
22					23	$+2/-4.5^{2}$		
					20	+2/-4.5		
23					23	+2/-3		
23					23	+2/-3		
24					23	$+2/-3^{2}$		
26					23	$+2/-3^{2}$		
20					23	+2/-3		
28					23	+2/-3		
					23	+2/[-3]		
33					23	+2/-3		
33					23	+2/-3		
						+2/-3		
35					23			
36					23	+2/-3		
37					23	+2/-3		
38					23	+2/-3		
39					23	+2/-3		
40					23	+2/-3		
41					23	+2/-3 <sup>2</sup>		
42					23	+2/-4		
43					23	+2/-4		
44					23	+2/[-3]		
l t	<sup>2</sup> refers to th F <sub>UL_high</sub> – 4 M tolerance lin	MHz and $F_{UL_h}$ nit by 1.5 dB	<sub>iigh</sub> , the maxi	mum output p	ower require	within F <sub>UL_low</sub> ar ement is relaxed g frequencies, t	d by reducing	the lower
						o account the t		13 FF 3.

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

If UE is configured for transmission on single-antenna port, 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 ≤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.

If UE is configured for transmission on single-antenna port, 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 4 0 00 05	5	>6	≤ 1
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	10	>6	≤ 1
		55, 50	15	>8	≤ 1
			20	>10	≤ 1
	66000	41	5	>6	≤ 1
NS_04	6.6.2.2.2	41	10, 15, 20	Table	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
	0 0 0 0 4	01	40.45	> 40	≤ 1
NS_09	6.6.3.3.4	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
	0.0.3.3.11	20	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	
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 between two regions, notes 1 and 2 apply on a per slot basis.						
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]	<2004			≥2004					
3	L <sub>CRB</sub> [RBs]	1-1	15			>5				
	A-MPR [dB]	≤!	-			≤1				
	Fc [MHz]	<2004 2004 ≤		)4 ≤ Fc <	2007		≥2	007		
5	L <sub>CRB</sub> [RBs]	1-2	25			6 & -25	8-12		>	•6
	A-MPR [dB]	≤.	7		S	4	0		4	1
	Fc [MHz]	200	)5 ≤	Fc <2	015	;		201	5	
	RB <sub>start</sub>		0	-49				0-4	9	
10	L <sub>CRB</sub> [RBs]	1-50 ≤ 12			1-50					
	A-MPR [dB]				0					
	Fc [MHz]					<2012	.5			
	RB <sub>start</sub>	0-4		į	5-21		22-56			57-74
	L <sub>CRB</sub> [RBs]	≥1	7-	50	0-6 & ≥50		≤25	>2	5	>0
	A-MPR [dB]	≤15	4	≤7		≤10	0	≤6	6	≤15
15	Fc [MHz]					2012.	5			
	RB <sub>start</sub>	0-12			13-	-39	40-65			66-74
	L <sub>CRB</sub> [RBs]	≥1		≥3(	0	<30	≥ (69 – RB <sub>start</sub> )			≥1
	A-MPR [dB]	≤10 ≤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	≥25		≥1
	A-MPR [dB]	≤15	4	≦7		≤10	0	≤7	7	≤15

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

Channel bandwidth [MHz]	Parameters	Regi	Region B	
	RB <sub>start</sub>	C	)	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

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	Regi	on 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]	< 2007.5 2007.5 ≤ Fc < 2012.5 ≤ Fc ≤ 2012.5 ≤ Fc < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 < 2012.5 <					c ≤ 2017.5			
5	RB <sub>start</sub>	≤24 0-3			4-6	≤2	24			
5	L <sub>CRB</sub> [RBs]	>	0	1:	5-19	≥20	)	≥18	1-:	25
	A-MPR [dB]	Ì	17		≤1	≤4		≤2	≤	0
	Fc [MHz]					2	005			
	RB <sub>start</sub>		0-25			2	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]		≥(	32				≥40		
	A-MPR [dB]		≤	4				≤2		
	Fc [MHz]					20	12.5			
15	RB <sub>start</sub>		0-14				15-24		25-39	61-74
15	L <sub>CRB</sub> [RBs]	1-9 & 4	0-75	10-3	39	24-2	9	≥30	≥36	≤6
	A-MPR [dB]	≤11		≤6		≤1		≤7	≤5	≤6
	Fc [MHz]					2	010			
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	31-75	10-3	30	≥15	≥24	≥25	>0
	A-MPR [dB]	≤17 ≤12 ≤6 ≤		≤9	≤7	≤5	≤16			
NOTE 1: When NS_20 is signaled the minimum requirements for the 10 MHz bandwidth are specified for E-UTRA										
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	lo 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		
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.				
NOTE 2: The index of the seque <i>r10</i> .			rumEmissionSCell-	

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	$0 < L_{CRB} \le 10$	N/A	≤ 11.0	
	- 149	> 10	N/A	≤ 6.0	
75 RB / 75 RB	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>					
		ed for both slots in the subfra			

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-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 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

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

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.

If UE is configured for transmission on single-antenna port, 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-ban		E-UTRA Band	ΔT <sub>IB,c</sub> [dB]
Configura		1	0.3
CA_1A-	-5A	5	0.3
CA_1A-	184	1	0.3
	IUA	18	0.3
CA_1A-	19A	1	0.3
		19	0.3
CA_1A-	21A	1 21	0.3
		2	0.3
CA_2A-	17A	17	0.8
CA_2A-2	29A	2	0.3
CA_3A-	-5A	3	0.3
		5 3	0.3
CA_3A-	-7A	7	0.5
		3	0.3
CA_3A-	-8A	8	0.3
CA 3A-	201	3	0.3
CA_3A-	20A	20	0.3
CA_4A-	-5A	4	0.3
<b>.</b>		5	0.3
CA_4A-	-7A	4	0.5
		7 4	0.5 0.3
CA_4A-	12A	12	0.8
0.0.4.0	40.4	4	0.3
CA_4A-13A		13	0.3
CA_4A-	170	4	0.3
		17	0.8
CA_4A-2	29A	4	0.3
CA_5A-	12A	5 12	0.8
		5	0.4
CA_5A-	17A	17	0.4
	20.4	7	0.3
CA_7A-2	20A	20	0.3
CA_8A-	20A	8	0.4
		20	0.4
CA_11A-	-18A	11 18	0.3
NOTE 1	The ab	ove additional tolerances are only app	= =
		that belong to the supported inter-ban	
		irations	
		ove additional tolerances also apply in	
		ted E-UTRA operating bands that belo	ong to the supported inter-band
		aggregation configurations the UE supports more than one of th	e above inter-band carrier
		ation configurations and a E-UTRA or	
		er-band carrier aggregation configurat	
-	Whe	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	
		configurations. In case there is a harm	
		and high band DL, then the maximum	
		orted carrier aggregation configuration	ons involving such band shall be
	appl		
-		en the E-UTRA operating band freque	
		icable additional tolerance shall be th ies for that operating band among the	
	appl	ies for that operating band among the	supported CA configurations

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	4.0	)
13 ≤ P <sub>CMAX</sub> < 18	5.0	)
8 ≤ P <sub>CMAX</sub> < 13	6.0	)
-40 ≤ P <sub>CMAX</sub> < 8	7.0	)

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)	Tolerance T <sub>LOW</sub> (P <sub>CMAX_L,c</sub> ) (dB)	Tolerance Thigh(P <sub>CMAX_H,c</sub> ) (dB)			
$P_{CMAX,c} = 23$	3.0	2.0			
$22 \le P_{CMAX,c} < 23$	5.0	2.0			
$21 \leq P_{CMAX,c} < 22$	5.0	3.0			
20 ≤ P <sub>CMAX,c</sub> < 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			

If UE is configured for transmission on single-antenna port, 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 o	utput po	wer
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If UE is configured for transmission on single-antenna port, 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 bandwidth1.43.05101520MHzMHzMHzMHzMHzMHz						
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	

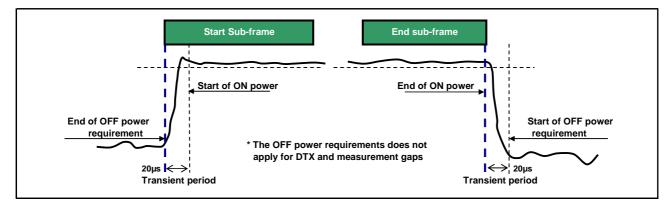
 Table 6.3.3B.1-1: Transmit OFF power per antenna port

# 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

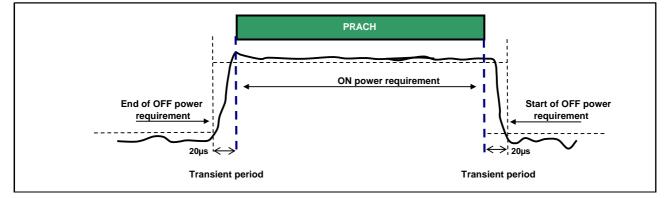


Figure 6.3.4.2-1: PRACH ON/OFF time mask

#### 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

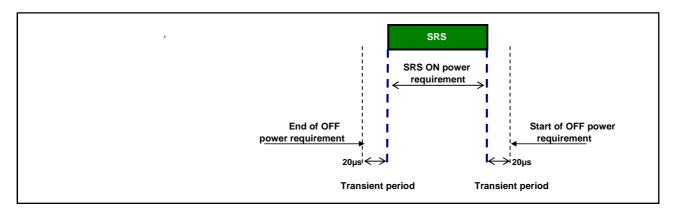


Figure 6.3.4.2.2-1: Single SRS time mask

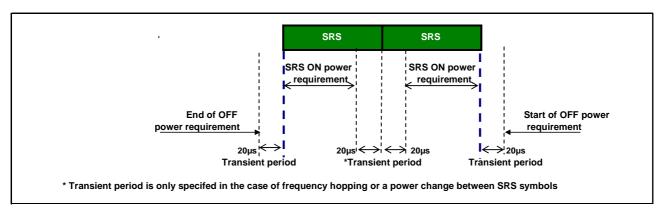


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

### 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.

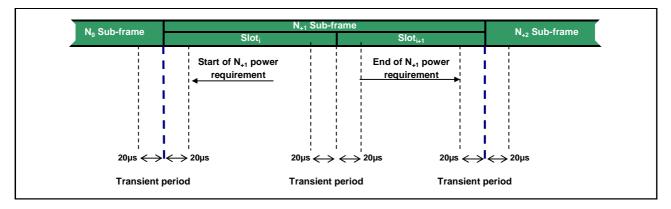


Figure 6.3.4.3-1: Transmission power template

# 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.

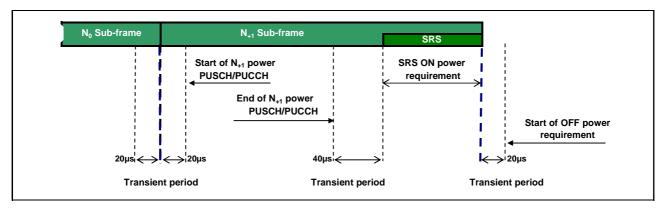


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

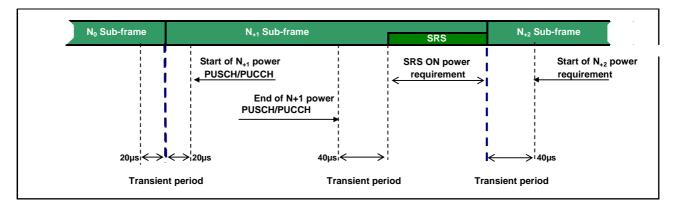


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

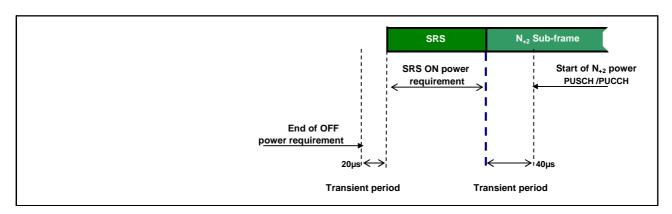
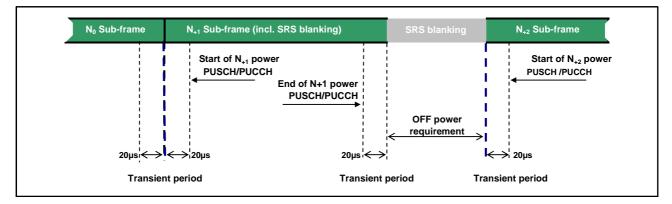
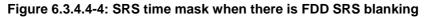


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before





# 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.

If UE is configured for transmission on single-antenna port, 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 ≤ ∆F	<b>'</b> < 3	±3.0	±4.0	±3.0
3 ≤ ΔF	<b>'</b> < 4	±3.5	±5.0	±3.5
4 ≤ ∆P	≤ 10	±4.0	±6.0	±4.0
10 ≤ ∆F	<b>'</b> < 15	±5.0	±8.0	±5.0
15 ≤	ΔP	±6.0	±9.0	±6.0
15 ≤ ΔP       ±6.0       ±9.0       ±6.0         NOTE 1:       For extreme conditions an additional ± 2.0 dB relaxation is allowed         NOTE 2:       For operating bands under Note 2 in Table 6.2.2-1, the relative power tolerance is relaxed by increasing the upper limit by 1.5 dB if the transmission bandwidth of the reference sub-frames is confined within F <sub>UL_low</sub> and F <sub>UL_low</sub> + 4 MHz or F <sub>UL_high</sub> – 4 MHz and F <sub>UL_high</sub> and the target sub-frame is not confined within any one of these frequency ranges; if the transmission bandwidth of the target sub-frame is confined within F <sub>UL_low</sub> and F <sub>UL_low</sub> + 4 MHz or F <sub>UL_high</sub> – 4 MHz and F <sub>UL_high</sub> and the reference sub-frame is not confined within any one of these frequency ranges, the tolerance is relaxed by reducing the lower limit by 1.5 dB.         NOTE 3:       For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods for TDD: for a power step ΔP ≤ 1 dB, the relative power tolerance for transmission is ±1.0 dB.			relative power 5 dB if the confined within high and the target lency ranges; if confined within high and the hese frequency ower limit by 1.5 source blocks those generated s for TDD: for a	

#### 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.

If UE is configured for transmission on single-antenna port, 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

Parameter	Unit	Average EVM Level	Reference Signal EVM Level
QPSK or BPSK	%	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: $P_{\scriptscriptstyle RB}$ 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).

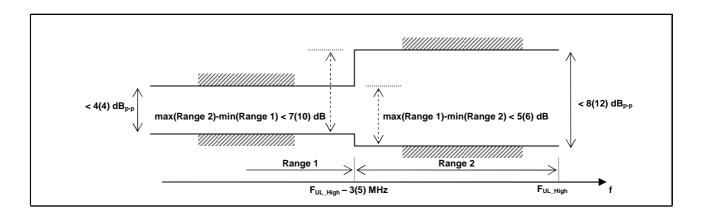
The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and 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_Meas</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]
$F_{UL_Meas} - F_{UL_Low} \ge 5 \text{ MHz} \text{ and } F_{UL_High} - F_{UL_Meas} \ge 5 \text{ MHz}$	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	n the equalizer coefficient is
evaluated	
NOTE 2: F <sub>UL_Low</sub> and F <sub>UL_High</sub> refer to each E-UTRA frequenc	y 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 P<sub>RB</sub> - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P<sub>RB</sub> 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. 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.					

Table 6.5.2A.3.1-1: Minimum requirements for in-band emissions (allocated component carrier)
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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 pandwidth		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	Two Exce Notes 1, {	5, 6, 7, 8, 9 from	Table 6.5.2	are allowed for up to two contiguous 2A.3.1-1 apply for Table 6.5.2A.3.1 3 in the non allocated component ca	-2 as well.	

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

#### 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.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.5.2 apply.

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

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.

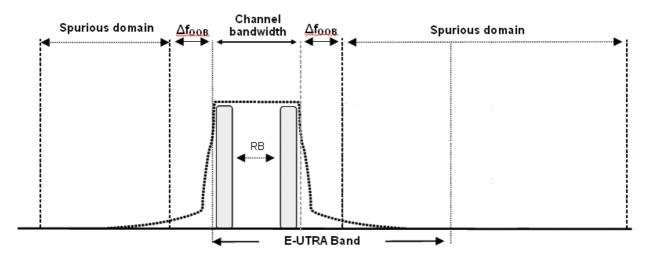


Figure 6.6-1: Transmitter RF spectrum

## 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 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Channel bandwidth	1.4	3	5	10	15	20
(MHz)		-	-			

Table 6.6.1B-1: Occupied channel bandwidth

If UE is configured for transmission on single-antenna port, 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			
± 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			
± 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			
± 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									
∆f <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>ООВ</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.

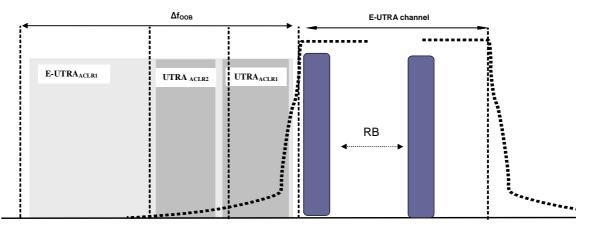
	Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>									
ſ	Δf <sub>oob</sub> (MHz)	50+100RB (29.9 MHz)	75+75B (30 MHz)	75+100RB (34.85 MHz)	100+100RB (39.8 MHz)	Measurement bandwidth				
Γ	± 0-1	-22.5	-22.5	-23.5	-24	30 kHz				
	± 1-5.5	-13	-13	-13	-13	1 MHz				
	$\pm 5.5-34.9$	-25	-25	-25	-25	1 MHz				
	$\pm$ 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	1.4 3.0 5 10 15 2							
	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-UTRAAC	LR1 shall be	applicab	le 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	ACLR1/2 / Measurem	ent 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 /	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
			nce with UTRA FDD nce with UTRA TDD			

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

#### 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
	DD co-existence with UTRA FDD in paired spectrum. DD 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: Genera	I requirements for	CA E-UTRA <sub>ACLR</sub>
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	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.

If UE is configured for transmission on single-antenna port, 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
С	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		ency MHz	range 2)	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	$F_{DL_{low}}$	_	$F_{DL\_high}$	-50	1					
	E-UTRA Band 3, 34	FDL_low	-	FDL_high	-50	1	15				
	Frequency range	1880		1895	-40	1	15,27				
	Frequency range	1895		1915	-15.5		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 <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1					
	E-UTRA Band 2, 25	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	15				
	E-UTRA Band 43	$F_{DL_{low}}$	-	$F_{DL_high}$	-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 <sub>DL_high</sub>	-50	1					
	E-UTRA Band 3	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	15				
	E-UTRA Band 11, 18, 19, 21	$F_{DL\_low}$	-	F <sub>DL_high</sub>	-50	1	13				
	E-UTRA Band 22, 42	$F_{DL\_low}$	-	$F_{DL_high}$	-50	1	2				
	Frequency range	1884.5	-	1915.7	-41	(MHz) 1 1 1 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1	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	(MHz) 1 1 1 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1					
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50		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						
	E-UTRA Band 41	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	-	2				
0	E-UTRA Band 26	859	-	869	-27						
6	E-UTRA Band 1, 9, 11, 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50						
	Frequency range	860	-	875	-37						
	Frequency range	875	-	895	-50	1					
		1884.5	-	1919.6	-41	0.3	7				
	Frequency range	1884.5	-	1915.7			8				
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43	$F_{DL\_low}$	-	$F_{DL_{high}}$	-50						
	Frequency range	2570	-	2575	+1.6		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>	-	$F_{DL_high}$	-50						
	E-UTRA band 3	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50		2				
	E-UTRA band 7	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50		2				
	E-UTRA Band 8	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50		15				
	E-UTRA Band 22, 41, 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50		2				
	E-UTRA Band 11, 21	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50		23				
	Frequency range	860	-	890	-40		15, 23				
0	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						
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50		2				
	Frequency range	1884.5	-	1915.7	-41		8				
	Frequency range	945	-	960	-50						
	Frequency range	1839.9	-	1879.9	-50	1					
	Frequency range	2545	-	2575	-50	1					
10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 41, 43	$F_{DL\_low}$		$F_{DL_{high}}$	-50						
	E-UTRA Band 22, 42	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	2				
11	E-UTRA Band 1, 11, 18, 19, 21, 28, 34, 42	$F_{DL_{low}}$		$F_{DL_high}$	-50						
	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,	-		-	-50	1	
	25, 26, 27, 41		-	F <sub>DL_high</sub>	50	1	2
	E-UTRA Band 4, 10	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
13	E-UTRA Band 12 E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23,	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	. I	15
15	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	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	2
	E-UTRA Band 12	$F_{DL_{low}}$	1	$F_{DL_high}$	-50	1	15
18	E-UTRA Band 1, 11, 21, 34, 42	$F_{DL_{low}}$	1	$F_{DL_high}$	-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	$F_{DL_{low}}$	-	$F_{DL_high}$	-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	
20	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34,	2040	-	2373			
20	40, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	
	E-UTRA Band 20	$F_{DL\_low}$	-	$F_{DL_high}$	-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	-	1879.9	-50	1	
22	Frequency range E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28,	2545	-	2575	-50	1	
22	33, 34, 38, 39, 40, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$	-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>	-	$F_{DL_high}$	-50	1	
24	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, 41	-	-	F	-50	1	
	E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23,	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>			
25		F <sub>DL low</sub>	-	$F_{DL_high}$	-50	1	15
25	24, 26, 27, 28, 29, 41, 42 E-UTRA Band 2		-	FDI N	-50	1	10
25	E-UTRA Band 2	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>			
25	E-UTRA Band 2 E-UTRA Band 25	F <sub>DL_low</sub>	-	$F_{DL_high}$	-50	1	15
25	E-UTRA Band 2 E-UTRA Band 25 E-UTRA Band 43	F <sub>DL_low</sub>	-				
	E-UTRA Band 2 E-UTRA Band 25 E-UTRA Band 43 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29,	F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub>	-	F <sub>DL_high</sub> F <sub>DL_high</sub>	-50	1	15
	E-UTRA Band 2           E-UTRA Band 25           E-UTRA Band 43           E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43	F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub>	-	F <sub>DL_high</sub> F <sub>DL_high</sub> F <sub>DL_high</sub>	-50 -50 -50	1 1 1	15 2
	E-UTRA Band 2           E-UTRA Band 25           E-UTRA Band 43           E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43           E-UTRA Band 41	F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub>	-	F <sub>DL_high</sub> F <sub>DL_high</sub> F <sub>DL_high</sub> F <sub>DL_high</sub>	-50 -50 -50 -50	1 1 1 1	15 2 2
	E-UTRA Band 2           E-UTRA Band 25           E-UTRA Band 43           E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43	F <sub>DL</sub> low F <sub>DL</sub> low F <sub>DL</sub> low F <sub>DL</sub> low F <sub>DL</sub> low 1884.5	-	$\frac{F_{DL\_high}}{F_{DL\_high}}$ $\frac{F_{DL\_high}}{F_{DL\_high}}$ 1915.7	-50 -50 -50 -50 -41	1 1 1 1 0.3	15 2
	E-UTRA Band 2           E-UTRA Band 25           E-UTRA Band 43           E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43           E-UTRA Band 41	F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub> F <sub>DL_low</sub>	-	F <sub>DL_high</sub> F <sub>DL_high</sub> F <sub>DL_high</sub> F <sub>DL_high</sub>	-50 -50 -50 -50	1 1 1 1	15 2 2

	Frequency range	1839.9	-	1879.9	-50	1	
27	E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13,	_		_	-50	1	
	14, 17, 23, 25, 26, 27, 29, 38, 41, 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>			
	Frequency range	799	-	805	-35	0.00625	
00	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 <sub>DL_low</sub>	-	$F_{DL_high}$	-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,				-50	1	5
	40, 42, 43	F <sub>DL_low</sub>	-	$F_{DL_high}$			
	E-UTRA Band 3	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	15
34	E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20,				50		
	21, 22, 26, 28, 33, 38,39, 40, 41, 42, 43, 44	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	5
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	1839.9	-	1879.9	-50	1	
35							
36							
37			-				
38	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	
	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	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1	
40	E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 28, 33, 34, 38, 39, 41, 42, 43, 44	F <sub>DL low</sub>	-	F <sub>DL_high</sub>	-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 <sub>DL_high</sub>	-50	1	
	E-UTRA Band 9, 11, 18, 19, 21	F <sub>DL_low</sub>	-	FDL_high	-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,	1004.0		1313.7			0,00
	18, 19, 20, 21, 25, 26, 27, 28, 33, 34, 38, 40, 41, 44	$F_{DL_{low}}$	-	$F_{DL_high}$	-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	$F_{DL\_low}$		$F_{DL_{high}}$	-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	$F_{DL_{low}}$	-	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

	transmission bandwidth less than or equal to 54 RB.
NOTE 28	
NOTE 29	: N/A.
NOTE 30	: This requirement applies when the E-UTRA carrier is confined within 2545-2575 MHz and the channel bandwidth is 10 or 20 MHz.
NOTE 31	: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718- 728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart<48.
NOTE 32	: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.

### 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	$F_{DL_{low}}$	-	$F_{DL_high}$	-50	1			
CA 70	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	$F_{DL\_low}$	_	$F_{DL_high}$	-50	1			
		· DL_IOW		· DL_nigh					
CA_38C	E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29,								
CA_30C	33, 34, 40, 42, 43	F <sub>DL low</sub>	-	$F_{DL_high}$	-50	1			
		02_101		Be_nigh					
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,	I DL_low	-	DL_high					
_	14, 17, 23, 24, 25, 26, 27, 28, 29, 34, 39,				-50	1			
	40, 42, 44	F <sub>DL_low</sub>		F <sub>DL_high</sub>					
NOTE 1: NOTE 2:	As exceptions, measurements with a level 6.6.3.1-2 are permitted for each assigned 4 <sup>th</sup> [or 5 <sup>th</sup> ] harmonic spurious emissions	vel up to th ed E-UTRA . Due to sp	e a ca rea	oplicable re rrier used i ding of the	equirements de n the measure harmonic emis	efined in Ta ment due to ssion the e	o 2 <sup>nd</sup> , 3 <sup>rd</sup> , xception		
	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)	, wl	nere N is 2	, 3, 4, [5] for th	e 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4	l <sup>th</sup> [or 5 <sup>th</sup> ]		
	harmonic respectively. The exception is	allowed if	the	measurem	ent bandwidth	(MBW) tot	ally or		
	partially overlaps the overall exception i					ements son	ne		
	restriction will be needed for either the c	perating b	and	or protect	ed band				
NOTE 4: NOTE 5:									
NOTE 5.									
NOTE 7:									
NOTE 8:									
NOTE 9:									
NOTE 10	: The requirement also applies for the fre						ble		
	6.6.3.1-1 and Table 6.6.3.1A-1 from the	edge of th	e ag	ggregated	channel bandv	vidth.			
NOTE 11	: N/A : For these adjacent bands, the emission	limit could	im	ly rick of h	armful interfer	ance to			
NOTE 12	UE(s) operating in the protected operati		шţ						

#### Table 6.6.3.2A-1: Requirements for intra-band contiguous CA

### 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)		annel 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: Additional requirements (PHS)

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 bandwidth with $f_c = 1930$ MHz						
RB <sub>start</sub>	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)	5MHz	10MHz		
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 ba	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 edge at or above 814.2 MHz.					
NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.					

#### 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 chan above 819 MHz.		nnel edge at or
NOTE 2: The emissions measurement shall be sufficiently power averaged to ensistandard 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 ensure a standard 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.

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 ensistandard deviation < 0.5 dB.		aged to ensure a

### 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.

Table 6.6.3.3.12-1:	Additional	requirements
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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.

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	MBW
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 an from the lower and from the upper edge of the channel band whenever these frequencies overlap with the specified frequ		dwidth,
Note 2:	Note 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: This emission limit might imply risk of harmful interference to in the protected 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)							
	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					
	andwidth, whenever these frequencies overlap						
specified freq							
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 -	+					
Foffset_NS_23 ab	ove the upper E-UTRA channel edge to 3800	MHz.					
NOTE 3: F <sub>offset_NS_23</sub> is:							
	MHz channel BW,						
5 MHz for 10	) MHz channel BW,						
9 MHz for 15	9 MHz for 15 MHz channel BW and						
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	-	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)		nge (MHz)	Maximum Level (dBm)	MBW (MHz)	Note	
E-UTRA band 34	$F_{DL_{low}}$	I	$F_{DL_high}$	-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	1915	1	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.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	
Frequency range       2645       -       2690       -40       1       1, 3         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>i</sup> For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.         NOTE 3:       This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570-2615 MHz.							

### 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	I	2595	-15.5	5	1,2		
Frequency range	2595	I	2620	-40	1			
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.

If UE is configured for transmission on single-antenna port, 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)	5N	lHz	10MHz		15N	1Hz	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	-4(	0dBc	
Intermodulation Product	-29dBc	-35dBc	
Measurement bandwidth	BW <sub>Channel_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.

If UE is configured for transmission on single-antenna port, 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

Channel bandwidth									
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			-1007	-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		
20	101.7	101.7	-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		
20	-103.2	-100.2	-98	-95			FDD		
28	100.2	-100.2	-98.5	-95.5	-93.7	-91	FDD		
		100.2	00.0	00.0			100		
 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	-100.2	-102.2	-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		
40			-100	-97	-93.2	-92	TDD		
41			-98	-95 -96	-94.2	-92	TDD		
42			-99	-96 -96	-94.2	-93	TDD		
43		[-100.2]	[-98]	-96 [-95]	[-93.2]	[-92]	TDD		
NOTE 1:	The transmitter						ססי		
NOTE 2:	Reference meas						NG		
	Pattern OP.1 FD	D/TDD as	described	in Annex A					
NOTE 3:	The signal powe				d O the f	oronoo	oitivity		
NOTE 4:	For the UE whic level is FFS.	n supports	DOIN BANG	is and Bar	iu a the ref	erence sen	SILIVITY		
NOTE 5:	For the UE whic	h supports	both Band	11 and Ba	ind 21 the i	eference s	ensitivity		
	level is FFS.						-		
NOTE 6:	<sup>6</sup> indicates that the	he requirem	nent is mo	dified by -0	.5 dB wher	the carrie	r 04 Mill-		
NOTE 7:	frequency of the For a UE that su								
						0100 30131			
for Band 26 applies for the applicable channel bandwidths.									

Table 7.3.1-1: Reference sensitivity QPSK PREFSENS	Table 7.3.1-1:	Reference	sensitivity	QPSK	PREFSENS
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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]									
CA_1A-5A		1	0									
		5	0									
CA_1A-18A		1	0									
		18	0									
CA_1A	-19A	1	0									
		19	0									
CA_1A-21A		21	0									
		2	0									
CA_2A-17A		17	0.5									
	- •	3	0									
CA_3A-5A		5	0									
	7.0	3	0									
CA_3A	A-7A	7	0									
CA 3A	Q /	3	0									
CA_3A-8A		8	0									
CA_3A	-20A	3	0									
	_0,1	20	0									
CA_4A	-5A	4	0									
		5	0									
CA_4A-7A		4	0.5									
		4	0.5									
CA_4A	-12A	12	0.5									
		4	0.0									
CA_4A	-13A	13	0									
		4	0									
CA_4A	-17A	17	0.5									
	104	5	0.5									
CA_5A	-12A	12	0.3									
CA_5A	-17Δ	5	0.5									
0/(_0/(	177	17	0.3									
CA_7A	-20A	7	0									
		20	0									
CA_8A	-20A	8	0									
		20	0									
CA_11A	-18A	11	0									
NOTE 1	The sh	18 ove additional tolerances are only ap	0 Disable for the E-LITRA operating									
NOTE 1.												
		s that belong to the supported inter-band carrier aggregation gurations										
NOTE 2:		ove additional tolerances also apply i	n intra-band CA and non-									
		gated operation for the supported E-UTRA operating bands that belong to										
		pported inter-band carrier aggregation configurations										
NOTE 3: In case the UE supports more than one of the above inter-band carrier												
aggregation configurations and a E-UTRA operating band belongs to more than												
one inter-band carrier aggregation configurations then: When the F LITP $\Lambda$ operating band frequency range is < 1GHz, the												
- When the E-UTRA operating band frequency range is $\leq$ 1GHz, the applicable additional tolerance shall be the average of the tolerances in												
Table 7.3.1-1A, truncated to one decimal place that would apply for that												
operating band among the supported CA configurations. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported carrier aggregation configurations involving such band shall be applied When the E UTB A operating hand frequency range is $\geq 1$ CHz, the												
							- When the E-UTRA operating band frequency range is >1GHz, the applicable additional tolerance shall be the maximum tolerance in Table					
						7.3.1-1A that would apply for that operating band among the supported						

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			E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode								
Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode				
1			25	50	75	100	FDD				
2	6	15	25	50	50 <sup>1</sup>	50 <sup>1</sup>	FDD				
3	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	-		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		15	25	25 <sup>1</sup>	25 <sup>1</sup>	25 <sup>1</sup>	FDD				
			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			25	50	75	100	TDD				
38			25	50	75	100	TDD				
39			25	50	75	100	TDD				
40			25	50	75	100	TDD				
41		ļ	25	50	75	100	TDD				
42			25	50	75	100	TDD				
43		ļ	25	50	75	100	TDD				
44		15	25	50	75	100	TDD				
<ul> <li>NOTE 1: <sup>1</sup> refers to 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).</li> <li>NOTE 2: For the UE which supports both Band 11 and Band 21 the uplink configuration for reference sensitivity is FFS.</li> <li>NOTE 3: <sup>3</sup> refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 16</li> </ul>											

 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 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_3A-8A <sup>4</sup>	3				N/A	N/A	N/A	FDD
CA_SA-6A	8			N/A	N/A			
CA_4A-12A <sup>5,6</sup>	4	-89.2	-89.2	-90	-89.5			FDD
CA_4A-12A	12			-96.5	-93.5			
CA_4A-17A <sup>5,6</sup>	4			-90	-89.5			FDD
CA_4A-17A	17			-96.5	-93.5			FUU
NOTE 1: The transmitter shall be set to $P_{UMAX}$ 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 NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply). NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. NOTE 6: The requirements should be verified for UL EARFCN of the low band (superscript LB) such that $f_{UL}^{LB} = \left[ f_{DL}^{HB} / 0.3 \right] 0.1$ in MHz and $F_{UL-low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL}^{LB} \le F_{UL-high}^{LB} - BW_{Channel}^{LB} / 2$ with $f_{DL}^{HB}$ the carrier frequency of the high band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the low band.								

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	guration for th L configuration rce blocks exp	ne channel bar on applies rega cceed that spe	ndwidth. ardless of th cified in Ta	he channe ble 7.3.1-2	el bandwidth	n of the low	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		
	2			-98	-95			FDD		
CA_2A-29A	29		-98.7	-97	-94			FDD		
	4			-100	-97			FDD		
CA_4A-29A	29		-98.7	-97	-94			FDD		
NOTE 2: Refer 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 configuration / CC combination / $N_{RB_{agg}}$ / Duplex mode										
Uplink CA	100RB	100RB+50RB 75RB		B+75RB 100RB		+75RB	100RB+100RB		Duplex		
configuration	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	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 1: The carrier control NOTE 2: The transmitted NOTE 3: The UL resources of the transmitted NOTE 3: The UL resources of the transmitted network of the t	ed power of	over both I	PCC and	SCC shal	I be set to	PUMAX as o	defined in s	ubclause 6	.2.5A.		

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

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

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.

CA configuration	Aggregated 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			
	25110+25110	$0.0 < W_{gap} \le 30.0$ $25^1$		0.0			
	25RB+50RB	$25.0 < W_{gap} \le 50.0$	10 <sup>1</sup>	4.5			
	2360+3060	$0.0 < W_{gap} \le 25.0$	25 <sup>1</sup>	0.0	FDD		
CA_25A-25A	50RB+25RB	15.0 < W <sub>gap</sub> ≤ 50.0	10 <sup>4</sup>	5.5	FDD		
	JUKD+2JKD	0.0 < W <sub>gap</sub> ≤ 15.0	32 <sup>1</sup>	0.0			
		10.0 < W <sub>gap</sub> ≤ 45.0	5.0				
	50RB+50RB	$0.0 < W_{gap} \le 10.0$	0.0				
CA_41A-41A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD		
Operat 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	ting band but confi s the sub-block ga arrier center freque ing band. s to the UL resour- e TDD intra-band r synchronized ope mbinations 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 operatir ce blocks shall be located at R non-contiguous CA configuration eration between all component nel bandwidths defined in Tab gap sizes. une as Transmission bandwidth	ng band is conf B <sub>start</sub> =33. ons, the minim carriers. le 5.6A.1-3.	igured close	r to the DL ents apply		

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

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## 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						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	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	arameter 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 est BW</sub> )			
<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	NOTE 1: The transmitter shall be set to 24dB below PCMAX_L at the minimum uplink configuration specified in Table								
		x_L as defined in				·			
NOTE 2: The int	erferer co	nsists of the Rel	ference measur	ement channel sp	pecified in Anne	x 3.2 with one s	ided dynamic		
OCNG	Pattern O	P.1 FDD/TDD a	as 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	A 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 PCMA	X_L,c or PCMAX_L a	as defined in s	ubclause 6.2.5	5A.
NOTE 2: The interferer consists of						
dynamic OCNG Pattern	OP.1 FDD	/TDD as de	scribed in Annex	x A.5.1.1/A.5.2	1.1 and set-up	according to
Annex C.3.1						
NOTE 3: The Finterferer (offset) is the						
interferer and the cente						djusted to
$F_{interferer} / 0.015 + 0.5 0.15$	015 + 0.007	5 MHz to b	e offset from the	sub-carrier ra	ster.	

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

Table 7.5.1A-3: Test	parameters for Adiace	nt channel selectivity, Case 2

Rx Parameter	Units	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 b	andwidth			
		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	'.3.1-2 wi	th PCMAX_L as c	defined in subc	lause 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	may not fall inside the			
NOTE 2: For ea	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: FInterfer	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		RE	EFSENS + CA B	andwidth Class	dwidth Class specific value below				
Bandwidth Configuration, per CC	dBm		12						
BWInterferer	MHz		5						
Floffset, case 1	MHz		7.5						
Floffset, case 2	MHz		12.5						
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: The 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 and set-up according to Annex C.3.1									

Table 7.6.1	.1A-1: In	band k	olocking	parameters
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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_41C		MHz	(Note 2)	F <sub>DL_low</sub> – 15 to F <sub>DL_high</sub> + 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: Foffset is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.							
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 $\left  F_{\text{interferer}} / 0.015 + 0.5 \right  0.015 + 0.0075 \text{ MHz}$ 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	s Channel bandwidth					
		1.4	3 MHz	5 MHz	10	15	20
		MHz			MHz	MHz	MHz
Power in		REFSENS + channel bandwidth specific value below					
Transmission	dBm						
Bandwidth	ubiii	6	6	6	6	7	9
Configuration							
NOTE 1: The transmit	ter shall be	e set to 40	dB below I	Рсмах_∟ at	the minim	num uplink	ζ.
configuration	specified i	in Table 7	7.3.1-2 wit	h PCMAX_L	as define	d in subcla	ause
6.2.5.	6.2.5.						
	Reference measurement channel is specified in Annex A.3.2 with one sided						
dynamic OC	NG Pattern	OP.1 FE	DD/TDD a	s describe	ed in Anne	x A.5.1.1/	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 (PInterferer) for Rar	nge 3 shall be mod	lified to -20 dBm for	$F_{\text{Interferer}} > 2800$	
MHZ	and F <sub>Interferer</sub> < 4	1400 MHZ.					

#### Table 7.6.2.1-2: Out of band blocking

#### 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	aggregation with	one active uplink

Paramete	er Unit	Range 1	Range 2	Range 3
Pw	dBm	Table 7.6.	2.1-1 for both component of	arriers
Pinterferer	dBm	-44 + ΔR <sub>IB,c</sub>	$-44 + \Delta R_{IB,c} \qquad -30 + \Delta R_{IB,c}$	
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:	F <sub>DL_Low(1)</sub> ai	nd F <sub>DL_High(1)</sub> denote the respec	tive lower and upper frequ	ency limits of the lower
	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	i.
NOTE 3:	For F <sub>DL_Low</sub>	$_{(1)}$ – 15 MHz $\leq$ f $\leq$ F <sub>DL_High(1)</sub> + 1	5 MHz and $F_{DL\_Low(2)} - 15$ I	$MHz \le f \le F_{DL_{High(2)}} + 15$
	MHz the ap	propriate adjacent channel se	lectivity and in-band blocki	ng 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		REFSENS + CA Bandwidth Class specific value below					
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.							

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
	<b>E</b>		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						
Falameter	Unit	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Р	P <sub>REFSENS</sub> + channel-bandwidth specific value below							
Pw	dBm	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	l Init	CA Bandwidth Class						
Parameter	Unit	В	C	D	E	F		
Pw in Transmission Bandwidth	alDura	REFSENS + CA Bandwidth Class specific value below						
Configuration, per CC	dBm		16 <sup>4</sup>					
P <sub>uw</sub> (CW)	dBm		-55					
Fuw (offset for			- F <sub>offset</sub> – 0.2					
	MHz		/					
$\Delta f = 15 \text{ kHz}$ )			+ F <sub>offset</sub> + 0.2					
Fuw (offset for	MHz							
$\Delta f = 7.5 \text{ kHz}$	IVIEZ							
NOTE 1: The transmitter shall be	set to 4dB below F	CMAX_L,c Or I	PCMAX_L as defined	in subclause	e 6.2.5A.			
NOTE 2: Reference measuremen	it channel is specifi	ied in Annex	A.3.2 with one sid	led dynamic	<b>OCNG</b> Patte	ern OP.1		
FDD/TDD as described	in Annex A.5.1.1/A	.5.2.1.						
NOTE 3: The Fuw (offset) is the free	equency separation	n of the cent	er frequency of the	e carrier clos	est to the int	terferer and		
	the center frequency of the interfererand shall be further adjusted to $ F_{interferer}/0.015 + 0.5 0.015 + 0.0075 \text{ MHz}$							
to be offset from the sub	-carrier raster.		_		-			
NOTE 4: The requirement is appli	ied for the band co	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 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz							
Power in REFSENS + channel bandwidth specific value below									
Transmission BandwidthdBm666679Configuration9									
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	Rx Parameter Units CA Bandwidth Class					
B C D E F						
Pw in Transmission Bandwidth	smission Bandwidth dBm REFSENS + CA Bandwidth Class specific value below					
Configuration, 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

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					20 MHz	
Power in		REFSENS + channel bandwidth specific value below						
Transmission Bandwidth	dBm	12 8		6	6	7	9	
Configuration P <sub>Interferer 1</sub> (CW)	dBm	-46						
P <sub>Interferer 2</sub> (Modulated)	dBm		-46					
BW Interferer 2		1.4 3 5						
F <sub>Interferer 1</sub> (Offset)	MHz	-BW/2 -2.1 -BW/2 -4.5 -BW/2 -7.5 / / / / / / +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 paramet	ter Units	CA Bandwidth Class							
						F			
Pw in		REFSENS + CA Bandwidth Class specific value below							
Transmission									
Bandwidth	dBm		12						
Configuration, CC	, per								
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*FInterferer 1							
			B below PCMAX_L,c	-					
	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.								
						dia Annay			
	–								
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.3.1.									
	bandwidth 25MHz.								
			ncy separation of	f the center freq	uency of the car	rrier closest to			
			ency of the CW i						
			of the carrier clo						
of t	he 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 Maximum Note bandwidth level								
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 f \leq 5^{\text{th}} \ \text{harmonic} \\ \text{of the upper frequency edge} \\ \text{of the DL operating band in} \\ \text{GHz} \end{array}  \begin{array}{c} 1 \ \text{MHz} \\ -47 \ \text{dBm} \\ 1 \\ 1 \\ -47 \ \text{dBm} \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $								
NOTE 1: Applies only for Band 22, Band 42 and Band 43         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.								

# 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					
<ul> <li>NOTE 1: 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> <li>NOTE 2: The requirements apply when the UE is configured for carrier aggregation but is not transmitting.</li> </ul>							

# 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 bandwidth class						
Rx parameter	Units	Α	В	С	D	Е	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
con CA: con 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 and applicability and test rules					
of C	of CA performance requirements 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 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.					

### 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.

Param	eter	Unit	Test 1- 5	Test 6- 8	Test 9- 15	Test 16- 18	Test 19
Downlink now	$\rho_A$	dB	0	0	0	0	0
Downlink powe allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
	σ	dB	0	0	0	0	0
$N_{_{oc}}$ at ante	enna port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for u	nused PRBs		OCNG (Note 2)				
Modulation			QPSK	16QAM	64QAM	16QAM	QPSK
PDSCH transn	nission mode		1	1	1	1	1
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.							
Note 3: Void. Note 4: Void.							

#### Table 8.2.1.1.1-1: Test Parameters

				Drama	Connolation	Reference	value	
Test num.	Band- width	Reference channel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate 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
/	5 MHz	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	1
0	10 MHz	R.3 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2
8	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
	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
l í	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: Note 2: Note 3:	Void.							

Table 8.2.1.1.1-2: Minimum performance (FRC)	Table 8.2.1.1.1-	2: Minimum	performance (FRC)	)
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Table 8.2.1.1.1-3: Test Para	ameters for CA
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Pa	arameter	Unit	Test 1-2
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)

	σ	dB	0				
$N_{oc}$ at antenna port		dBm/15kHz	-98				
Symbols	for unused PRBs		OCNG (Note 2)				
Ν	<i>I</i> odulation		QPSK				
PDSCH t	ransmission mode		1				
Note 1: $P_B$	= 0.						
wit	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.						
Note 3: PUCCH format 1b with channel selection is used to feedback ACK/NACK.							
Note 4: The	e same PDSCH transmis	sion mode is appli	ed to each component carrier.				

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA

		Reference channel		Propa-	Correlation matrix and antenna config.	Reference value		
Test num.			OCNG pattern	gation condi- tion		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.

Paramete	·	Unit	Test 1			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)			
	σ	dB	0			
$N_{\it oc}$ at antenna	a port	dBm/15kHz	-98			
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)			
PDSCH transmissi	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 clot						
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 8.2.1.1.4-1: 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.

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)
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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)

Γ	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
Γ	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.

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 <sub>oc2</sub>	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 Configura	ition		Non-MBSFN	Non-MBSFN		
Time Offset between	Cells	μs	2.5 (synchron	ious cells)		
Cell Id			0	1		
ABS pattern (Note	5)		N/A	11000100 11000000 11000000 11000000 11000000		
RLM/RRM Measurement Pattern (Note 6)			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 mea	ne aggressor / ed in OFDM s ed in all OFDM fined in [9]. surement reso	ymbols #0, #4, #7, #11 of a A symbols of a subframe or purce restriction pattern for	a subframe overlapping verlapping with aggresson PCell measurements as	with the aggresso or non-ABS s defined in [7]		
<ul> <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 and Cell2</li> </ul>						

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

agg is the same. SIB-1 will not be transmitted in Cell2 in this test.

Note 9:

Test Number	Reference Channel		NG tern	Cone	agation ditions ote 1)	Correlation Matrix and Antenna	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.					
Note 3: Note 4:	<ol> <li>The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.</li> </ol>								
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
subframe ov Note 3: This noise is aggressor A Note 4: This noise is Note 5: ABS pattern Note 6: Time-domai [7] Note 7: As configure measureme Note 8: The number indicated by	verlapping v s applied in BS. s applied in as defined n measurer ed according nts defined of control ( "0" of ABS	vith the aggresso OFDM symbols all OFDM symbol in [9]. nent resource re g to the time-don in [7]. OFDM symbols is pattern.	#1, #2, #3, #5, #6, # or ABS. #0, #4, #7, #11 of a ols of a subframe ov striction pattern for I nain measurement r s not available for A 2 and Cell 3 in acco	subframe overlap erlapping with agg PCell measureme esource restriction BS and is 2 for the	pping with the gressor non-ABS nts as defined in n pattern for CSI e subframe
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	OC	NG Patte	ern	Propaga	ation Cor (Note1)	ditions	Correlation Matrix and	Reference	erence Value	
		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 $\widehat{E}$	$N_{oc2}$	of cell 1							
Note 4:		the servir	ng cell sul	bframe v	vhen 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	ort	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	•			1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission			2	N/A	N/A
Interference mod	Interference model		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
Physical channel for CQI	reporting		PUSCH(Note 5)	N/A	N/A
cqi-pmi-Configuration	Index		2	N/A	N/A
Note 1: $P_{R} = 1$			1	· · · ·	
Note 2: The respective red	eived power s	spectral density of	of each interfering	cell relative to $N_{c}$	$c_{c}$ is defined by
its associated DIP	value as spec	cified in clause B	.5.1.		
Note 3: Cell 1 is the servir					
Note 4: Cell 2 transmissio with respect to Ce			ell 1 by 0.33 ms an	d Cell 3 transmiss	sion is delayed
Note 5: To avoid collisions instead of PUCCH periodic CQI to me	between CQI	reports and HA format 0 shall b	e transmitted in do	ownlink SF#1 and	#6 to allow

# 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		opagat onditio		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	n 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
Develiele e ever	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	$\begin{array}{c c} \rho_{B} & dB & -3 \text{ (Not} \\ \hline \sigma & dB & 0 \\ \hline rt & dBm/15 \text{ kHz} & -98 \end{array}$	0
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	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)

				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			
Davinglin	Downlink power		dB	-3			
	Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
		σ	dB	0			
$N_{o}$	$_{c}$ at antenna	port	dBm/15kHz -98				
PDSCH	l transmissio	on mode	3				
Note 1:	$P_B = 1$ .						
Note 2:	PUCCH format 1b with channel selection is used to feedback ACK/NACK.						
Note 3:	The same componen		Insmission mode is	applied to each			

			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.

Parame	eter	Unit	Test 1-7		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)		
	σ	dB	0		
$N_{\scriptscriptstyle oc}$ at ante	nna port	dBm/15kHz	-98		
PDSCH transm	ission mode		3		
Note 1: $P_B = 1$	Due 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		70	15.1	
3 20MHz +	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 + 15MHz	R.30 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA70	2x2 Low	70	13.5	
4		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 + 10MHz	R.35-1 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.9	
0		R.35-3 FDD for 10MHz CC	OP.1 FDD (Note 1)			70	15.9	
7	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (Note 1)	EVA5	2x2 Low	70	15.9	
1	15MHz	R.35-2 FDD for 15MHz CC	OP.1 FDD (Note 1)			70	15.9	
Note 1: Note 2: Note 3:	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	num over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1- 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 Large Delay CD	D (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
Farameter	<u> </u>			
	$ 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 8.2.1.3.3-2	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, 11000000
	RLM/RRM Measurement Subframe Pattern(Note 6) 1000000 10000000 10000000 10000000			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	l symbols		2	2
PDSCH transmission			3	N/A
Cyclic prefix			Normal	Normal
overlapping with t Note 3: This noise is appl aggressor ABS. Note 4: This noise is appl Note 5: ABS pattern as de	he aggressor Å ied in OFDM sy ied in all OFDM efined in [9].	ymbols #1, #2, #3, #5, #6, ABS. ymbols #0, #4, #7, #11 of A symbols of a subframe o purce restriction pattern fo	a subframe overlapping	y with the sor non-ABS
Note 7: As configured acc measurements de	ording to the ti fined in [7].	me-domain measurement	resource restriction pa	ttern for CSI
Cell2 is the same. Note 9: SIB-1 will not be t	-			

# 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	Matrix and		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:	The maximum	n Through	put is cal	culated fro	om the tot	al Payload in 9 su	bframes, averag	ed over 4	10ms.

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

		•• •	· · · · · ·	<b>•</b> •• •
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
	$N_{oc1}$	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 8.2.1.3.3-4	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	9 5)		N/A	0001000000 0100000010 0000001000 0000000
	/RRM Measurement Subframe         0001000000           Pattern (Note 6)         0000001000           0000000000         0000000000			
C <sub>CSI,0</sub> CSI Subframe Sets (Note			0001000000 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 sub 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 sy ied in all OFDM efined in [9]. Th frames. asurement resc cording to the ti efined in [7]. ng cell. Cell 2 is ransmitted in C	/mbol #0 of a subframe of 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 i	verlapping with the aggr overlapping with aggress subframes indicated by A or PCell measurements a t resource restriction pa number of the CRS port	ressor ABS. sor non-ABS. ABS pattern are as defined in [7]. ttern for CSI s in Cell1 and
	mber of uplink	HARQ transmission is ≤ 2 ptected by MBSFN ABS in		nannel

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	statistically indepe	endent.		
Note 2:	SNR correspo	nds to $\widehat{E}$	$_{s}/N_{oc2}$ c	of cell 1.					
Note 3: Note 4:	Note 3:       The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.         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	Through	put is cald	culated fro	om the tota	al Payload in 4 su	bframes, averag	ed over 4	ums.

#### 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.

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)
	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
$\widehat{E}_s/N_{oc2}$	1	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>Channel</sub>		MHz	10	10	10
Subframe Configu	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	en Cells	μs	N/A	3	-1
Frequency shift betw	een Cells	Hz	N/A	300	-100
Cell Id			0	1	126
ABS pattern (No	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measu Subframe Pattern (			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	on mode		3	Note 9	Note 9
Cyclic prefixNote 1: $P_B = 1$ .	(		Normal	Normal	Normal
overlapping Note 3: This noise i aggressor A Note 4: This noise i Note 5: ABS pattern Note 6: Time-doma [7] Note 7: As configur measureme Note 8: The numbe	with the ag s applied in ABS. s applied in n as defined in measurer ed accordin ents defined r of control (	gressor ÅBS. OFDM symbols all OFDM symbol in [9]. nent resource re g to the time-don in [7]. OFDM symbols is	#1, #2, #3, #5, #6, #8, # #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 is as defined in pattern for CSI
Note 9: Downlink pl OCNG patt	ern as defin	nel setup in Cell ed in Annex A.5.			C.3.3 applying
			Cell 2 and Cell 3 is the	same.	

### Table 8.2.1.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

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		Propagation Conditions (Note1)				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:					, of cell 1		парріу і			nd Cell 3.			
Note 4:	Cell 1 transm	Refere	nce cha the se	annel is n rving cell	nodified:	PDSCH o e when th	ne subfra	me is ove	erlapped	l its associated with the ABS s			
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	Reporting mode		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 SF#n ba SF#(n-4)	- 8 -							

Table 8.2.1.4.1-1: Test Parameters for Si	ngle-Layer Spatial Multiplexing (FRC)
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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		
Downlink nowor	$ 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 on bitmap	estricti		0000000000000000 0000000000000000 000000		
PDSCH transmiss	sion		4		
mode					
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).					

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		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		2	2	2	
PDSCH transmission	mode		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	1)	ms	8	N/A	N/A
Reporting interva	l	ms	5	N/A	N/A
Reporting mode			PUCCH 1-1	N/A	N/A
CodeBookSubsetRestricti	on bitmap		1111	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: $P_{R} = 1$					•
Note 2: The respective rec	eived power	spectral density of	of each interfering	cell relative to $N_{a}$	$_{pc}$ 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, n 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		opagat onditio		Correlation 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:	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
$\widehat{E}_{s}/N_{oc2}$		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 (Note 5)			N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
	RLM/RRM Measurement Subframe Pattern (Note 6)		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 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
CodeBookSubsetRe 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

$P_B = 1$ .
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.
This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the
aggressor ABS.
This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
ABS pattern as defined in [9].
Time-domain measurement resource restriction pattern for PCell measurements as defined in
[7]
As configured according to the time-domain measurement resource restriction pattern for CSI
measurements defined in [7].
The number of control OFDM symbols is not available for ABS and is 2 for the subframe
indicated by "0" of ABS pattern.
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.
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.
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				Propagation Conditions (Note1)		Correlation Matrix and	Reference Value		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:								ally independen			
Note 2:	The correlation	on matrix	and ante	nna conf	iguration	apply for	Cell 1, C	Cell 2 and Cell 3.			
Note 3:	SNR correspo	onds to $\hat{I}$	$\hat{E}_s / N_{oc2}$ of	of cell 1.							
Note 4:	51 002										
Note 5:	The maximum	n Throug	hput is ca	alculated	from the	total Pay	load in 9	subframes, ave	raged over 40ms	S.	

### 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 r	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				
SF not later than SF#(n-4), this reported PMI cannot be							
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 value		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: Test Pa	arameters for Multi-Lav	er Spatial Multiplexing	(FRC)
	and the set of the set of a set of the set o	or opanial manipioning	,

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			
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.					
Note 5: Void.					

Table 8.2.1.4.3-2: Minimum perf	rmance Multi-Layer Spatial Multiplexing	(FRC)
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				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			
Develiate a surra	$ 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		000000000000000000000000000000000000000	000000000000000000000000000000000000000			
bitmap			00000000000 00000000				
			0000001111111	0000001111111			
			1111111110000	1111111110000			
			000000000000	000000000000			
CSI request field (	Note 3)		'1	0'			
PDSCH transmission	on mode		4	1			
Note 1: $P_B = 1$ .							
based on I reported P	PMI estimat	tion at a downlink S be applied at the eN	porting instance at s F not later than SF# IB downlink before \$	t(n-4), this SF#(n+4).			
Note 3: Multiple CC-s under test are configured as the 1 <sup>st</sup> set of serving cells by higher layers.							
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:	Note 1: The OCNG pattern applies for each CC.								
Note 2:	Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined								
	in 8.1.2.3.								

# 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		
Devertister	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
anooanon	σ	dB	0		
$\hat{E}_{s}_{-}{}^{PCell}$ at anter PCell	ina port of	dBm/15kHz	-85		
$\hat{E}_{s}$ _ $SCell$ at anten Scell	na port of	dBm/15kHz	-79		
$N_{\scriptscriptstyle oc}$ 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 appliedNote 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 8.2.1.7.1-1: Test Parameters for CA

Table 8.2.1.7.1-2: Minimum	performance	(FRC) for CA
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Test Number	Band- width		rence nnel	OCNG I	Pattern		gation itions	Correlation Matrix and Antenna		Reference value Fraction of Maximum Throughput (%)		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}			
sequence	0		{0,0,1,2}			
PDSCH transmiss of PCell	ion mode		3			
PDSCH tramsmiss of SCell	ion mode		3			
Note 1: $P_B = 1$ .						
	Note 2: The OCNG pattern is used to fill unused control channel and PDSCH.					

#### Table 8.2.1.8.1-1: Test Parameters for CA

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:	Note 1: The EPA200 propagation channels applied to PCell and SCell are statistically independent.									
Note 2:	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.

Parameter		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
$N_{_{oc}}$ at antenna port		dBm/15kHz	-98	-98	-98	-98	-98
Symbo			OCNG	OCNG	OCNG	OCNG	OCNG
unused			(Note 2)	(Note 2)	(Note 2)	(Note 2)	(Note 2)
Modul	ation		QPSK	16QAM	64QAM	16QAM	QPSK
ACK/N	IACK		Multiplexing	Multiplexing	Multiplexing	Multiplexing	Multiplexing
feedback	k mode						
PDS	•••		1	1	1	1	1
transmissi	on mode						
Note 1:	$P_B = 0$						
Note 2:	These phy	sical resource	blocks are ass	igned to an arl	pitrary number	of virtual UEs v	with one
					CNG PDSCH	s shall be unco	rrelated
pseudo random data, which is QPSK modulated.							
	Note 3: Void.						
Note 4:	Void.						

Table 8.2.2.1.1-2:	Minimum	performance	(FRC)

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.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		Test 1				
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0				
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
	σ	dB	0				
$N_{\it oc}$ 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:							
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	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 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		
$N_{\scriptscriptstyle oc}$ at antenna	port	dBm/15kHz	-98		
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)		
ACK/NACK feedbac	ck mode		Multiplexing		
PDSCH transmissio	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

Table 8.2.2.1.4-2: Minimum performance 1PRB (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.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		
$N_{_{oc}}$ 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 perfo	rmance Transmit Diversity (FRC)
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٦	<b>Fest</b>	Band-	Reference	e OCNG	Propagation	Correlation	Reference value		UE	
nu	ımber	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.

F	Parameter		Unit	Cell 1	Cell 2	
	wnlink conf			1	1	
Special sul	oframe con	figuration		4	4	
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
Downlink p allocati		$ 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 anter	ina port	$N_{oc2}$	dBm/15kHz	-98 (Note 3)	N/A	
		N <sub>oc3</sub>	dBm/15kHz	-94.8 (Note 4)	N/A	
$\hat{E}_s/N_{oc2}$			dB	Reference Value in Table 8.2.2.3-2	6	
	BW <sub>Channel</sub>		MHz	10	10	
Subfrar	ne Configu	ration		Non-MBSFN	Non-MBSFN	
Time Off	set betwee	n Cells	μs	2.5 (synch	ronous cells)	
	Cell Id			0	1	
ABS p	oattern (No	te 5)		N/A	0000010001 0000000001	
RLM/RRM M Pat	easuremer tern (Note			0000000001 0000000001	N/A	
CSI Subfran	ne Sets	C <sub>CSI,0</sub>		0000010001 0000000001	N/A	
(Note		C <sub>CSI,1</sub>		1100101000 1100111000	N/A	
Number of c	ontrol OFD	M symbols		2	2	
	CK feedbac			Multiplexing	N/A	
PDSCH t	ransmissio	n mode		2	N/A	
C	yclic prefix			Normal	Normal	
sub Note 3: This	noise is a frame over	apping with th oplied in OFD	M symbols #1, #2, #3, #5, e aggressor ABS. M symbols #0, #4, #7, #1 <sup>2</sup>			
Note 4: This			DM symbols of a subfrar	ne overlapping v	vith aggressor	
Note 5: ABS	Spattern as	defined in [9]				
		neasurement r	esource restriction patter	n for PCell meas	surements as	
	ned in [7].					
		according to th rements define	e time-domain measuren	nent resource re	striction pattern	
Note 8: Cell	1 is the se		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.			

#### Table 8.2.2.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

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.11-4 TDD (Note 4)	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Medium	70	3.8	≥2		
Note 1: Note 2:					Cell2 are s	statistically indepe	endent.				
Note 3: Note 4: Note 5:	The correlation Cell 1 Refere PDCCH/PCF ABS subfram	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. 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. The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 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 c	lownlink confi	guration		1	1	1
Special s	subframe con	figuration		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
	nk power cation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
			dB	0	N/A	N/A
N		N <sub>oc1</sub>	dBm/15kHz	-98 (Note 2)	N/A	N/A
$N_{oc}$ at a	ntenna port	$N_{oc2}$	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 8.2.2.2.3A-2	12	10
	BW <sub>Channel</sub>		MHz	10	10	10
Subfr	rame Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time C	Offset betwee	n Cells	μs	N/A	3	-1
Frequen	cy shift betwe	en Cells	Hz	N/A	300	-100
	Cell Id			0	126	1
ABS	S pattern (Not	e 5)		N/A	0000000001 0000000001	0000000001 0000000001
	RLM/RRM Measurement Subframe Pattern (Note 6)			0000000001 0000000001	N/A	N/A
	frame Sets	C <sub>CSI,0</sub>		0000000001 0000000001	N/A	N/A
	ote7)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Numb	er of control of symbols	OFDM		2	Note 8	Note 8
ACK/N	ACK feedbac	k mode		Multiplexing	N/A	N/A
	H transmissio			2	Note 9	Note 9
	Cyclic prefix			Normal	Normal	Normal
Note 1:	$P_{B} = 1$ .		I.			
Note 2: Note 3:	This noise is subframe ov This noise is	verlapping v applied in	vith the aggresso	#1, #2, #3, #5, #6, # or ABS. #0, #4, #7, #11 of a		
Note 4:		applied in		ols of a subframe ov	erlapping with age	gressor non-ABS
Note 5: Note 6:	ABS pattern			striction pattern for	PCell measureme	nts as defined in
Note 0.	[7]	inneasurei	lient resource re	Striction pattern for	i Gen measureme	
Note 7:				nain measurement i	esource restriction	n pattern for CSI
Note 8:		of control (	OFDM symbols is	s not available for A	BS and is 2 for the	e subframe
Note 9:	Downlink ph	ysical chan		2 and Cell 3 in acc	ordance with Anne	ex C.3.3 applying
Note 10: Note 11:	The number	of the CRS	Sports in Cell 1,	Cell 2 and Cell 3 is and Cell 3 is and 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	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:	The correlation	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	SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. 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. The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.										

# 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	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: $P_B = 1$ Note 2:The respective red	ceived power s				
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	ig cell. Cell 2, synchronous. between CQI	3 are the interfer reports and HA	ring cells. RQ-ACK it is nece		

# 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

periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Test Number	Reference Channel	OCNG Pattern			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 corresponds to $\widehat{E}_s/N_{oc}$ ´ of Cell 1 as defined in clause 8.1.1.										
	Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and 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.

Paramet	er	Unit	Test 1-2
Develiels rever	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{_{oc}}$ at anten	na port	dBm/15kHz	-98
ACK/NACK feed	oack mode		Bundling
PDSCH transmis	sion 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: $P_B = 1$									
Note 2: The same									

### Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

Test					Correlation	Referenc	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	Note 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	ACK/NACK feedback mode		- (Note 2)
PDSCH transmission	on mode		3
	st cases, the		is used to feedback ACK/NACK. Is mission mode is applied to each

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:	The applicabil 8.1.2.3.	ity of requirement	nts for differer	nt CA configuration	ns and bandwidth c	ombination sets is	defined i	n

# 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 nowor	$ 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				
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		Reference value		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	c downlink config	guration		1	1		
Specia	al subframe conf	iguration		4	4		
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3		
	link power ocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)		
		σ	dB	0	N/A		
			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/RR	M Measurement 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		
Note 1: Note 2: Note 3: Note 4: Note 5: Note 5: Note 6: Note 7: Note 8:	<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	Propa Cond (Not		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:	Cell 1 Refere PDCCH/PCF	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	onous 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		
CSI measureme Note 8: Cell 1 is the ser and Cell2 is the	ving cell. Cell		cell. The number of the	CRS ports in Cell1		
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 OCNG Pattern Channel		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	12.2	≥2
Note 1:	The propagat	ion condit	ions for C	ell 1 and 0	Cell2 are	statistically indepe	ndent.		
Note 2:	SNR corresp	onds to $\widehat{E}$	$\hat{C}_s/N_{oc2}$ of	of cell 1.					
Note 3: Note 4:	Cell 1 Refere PDCCH/PCF	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:						al Payload in 2 sul			

#### Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

# 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 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 cor			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 8.2.2.3.4-2	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 Configu	iration		Non-MBSFN	Non-MBSFN	Non-MBSFN				
Time Offset betwee	en Cells	μs	N/A	3	-1				
Frequency shift betw	een Cells	Hz	N/A	300	-100				
Cell Id			0	1	126				
ABS pattern (No	-		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 control symbols	OFDM		2	Note 8	Note 8				
ACK/NACK feedbad	k mode		Multiplexing	N/A	N/A				
PDSCH transmissio			3	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> </ul>									
Note 9: Downlink pl OCNG patte Note 10: The numbe	OCNG pattern as defined in Annex A.5.								

# Table 8.2.2.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

Test Num	Refer ence	$\widehat{E}_{s}/$	$N_{oc2}$	00	NG Patt	ern		ropagations (N		Correlation Matrix and	Reference Value		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: Note 3:							apply to	n Cell 1,	Cell 2 and	u Cell 3.			
	-s/-cz												
Note 4:	transr the su	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	e 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	PMI delay (Note 2)		10 or 11	10 or 11				
Reporting interval		ms	1 or 4 (Note 3)	1 or 4 (Note 3)				
Reporting mode			PUSCH 1-2	PUSCH 3-1				
CodeBookSubsetRestriction			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.	iownlink (	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.

Table 8.2.2.4.1A-1: Test Parameters for	Single-Layer Spatial Multiplexing (FRC)
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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	iter 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-Laye	r Spatial Multiplexing (FRC)
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Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	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	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	Cell Id			1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission			6	N/A	N/A
Interference mod	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 granula	rity	PRB	50	6	6
PMI delay (Note 4	1)	ms	10 or 11	N/A	N/A
Reporting interva	ms	5	N/A	N/A	
Reporting mode		PUCCH 1-1	N/A	N/A	
CodeBookSubsetRestricti		1111	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 1:  $P_B =$ 

Note 2: The respective received power spectral density of each interfering cell relative to  $N_{oc}$  is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: 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 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#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	DCNG Pattern 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 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:									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.

Pa	ameter		Unit	Cell 1	Cell 2	Cell 3	
Uplink down	link confi	iguration		1	1	1	
Special subfr	ame con	figuration		4	4	4	
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink p allocatio		$ 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 anten	na 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	
$\widehat{E}_{i}$	$N_{oc2}$		dB	Reference Value in Table 8.2.2.4.1C-2	12	10	
BV	V <sub>Channel</sub>		MHz	10	10	10	
Subframe	Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offse	t betwee	n Cells	μs	N/A	3	-1	
Frequency s	nift betwe	en Cells	Hz	N/A	300	-100	
(	Cell Id			0	126	1	
ABS pat	tern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001	
RLM/RRM Subframe I				0000000001 0000000001	N/A	N/A	
CSI Subfram	e 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	f control ( mbols	OFDM		2	Note 8	Note 8	
ACK/NAC		< mode		Multiplexing	N/A	N/A	
PDSCH tra	nsmissio	n mode		6	Note 9	Note 9	
	ng granul		PRB	50	N/A	N/A	
	ay (Note		ms	10 or 11	N/A	N/A	
Repor	ting inter	val	ms	1 or 4 (Note 11)	N/A	N/A	
	rting mod			PUSCH 3-1	N/A	N/A	
CodeBookS	ubsetRe itmap	striction		1111	N/A	N/A	
	lic prefix			Normal	Normal	Normal	
Note 1: $P_B$ Note 2: This over	=1. s noise is rlapping	s applied in with the ag	gressor ABS.	#1, #2, #3, #5, #6, #8, ;	<b>#</b> 9, #10,#12, #13	of a subframe	
<ul> <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> </ul>							
<ul> <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</li> </ul>							
Note 9: Dov	wnlink pr		nel setup in Cell	2 and Cell 3 in accorda	ance 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).							
	Uplink -			e reporting interval will a	alternate betwee	n 1ms and	
Note 12: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.							

#### 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.

Note 5:

Test Number	Reference Channel	OCNG Pattern		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 Note 4	OP.1 TDD	OP.1 FDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 High	70	6.4	≥2
Note 1: Note 2: Note 3:	The propagation The correlation SNR correspon	n matrix a	ind anten	na config				lly independent. Il 2 and Cell 3.			
Note 4:		he servir	ng cell su	bframe w	hen the s	subframe	is overla	ng and its associat pped with the ABS			ell and

#### ABS

#### 8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

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 ranktwo 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 inter	rval	ms	1 or 4 (Note 3)		
Reporting mo	de		PUSCH 3-1		
ACK/NACK feedba	ck mode		Bundling		
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 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).					
		configuration 1 the 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)

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.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.

Paramete	er	Unit	Test 1			
Downlink power	Downlink power $\rho_A$		-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 grar	ularity	PRB	6			
PMI delay (No	ote 2)	ms	10 or 11			
Reporting int	erval	ms	1 or 4 (Note 3)			
Reporting m	ode		PUSCH 1-2			
ACK/NACK feedb	ack mode		Bundling			
CodeBookSubset	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#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 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 antenna port	dBm/15kHz	-98					
Precoding granularity	PRB	8					
PMI delay (Note 2)	ms	10 or 11					
Reporting interval	ms	1 or 4 (Note 3)					
Reporting mode		PUSCH 1-2					
ACK/NACK feedback mode		PUCCH format 1b with channel selection					
CodeBookSubsetRestriction	1	000000000000000000000000000000000000000					
bitmap		00001111111111111111100000000					
		0000000					
CSI request field (Note 4)		'10'					
PDSCH transmission mode		4					
Note 1: $P_B = 1$ .							
based on PMI esti	D						
between 1ms and	<ol> <li>For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.</li> </ol>						
Note 4: Multiple CC-s und layers.							
Note 5: The same PDSCH	transmission mode is	applied to each component carrier.					

Table 8.2.2.4.3-4: Minimum	performance Multi-Laye	r Spatial Multiplexing	g (FRC) for CA
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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 bandwi	dth 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	
Develiek 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	
$N_{\it oc}$ 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 transmiss of SCell	ion mode		3	
Note 1: $P_{R} = 0$ .		•		
Note 2:Noexternal 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 8.2.2.7.1-2: Minimum	performance	(FRC) for CA
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Test Number	Band- width		rence nnel	OCNG Pattern		Propagation Conditions		Correlation Matrix and Antenna		Reference value Fraction of Maximum Throughput (%)		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 OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH. The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.											

# 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		
Davadiala	$ 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			Annex B.4.1	Annex B.4.1		
Cell-specific refere signals	ence		Antenna	ports 0,1		
CSI reference sign	nals		Antenna ports 15,,18	Antenna ports 15,,18		
CSI-RS periodicity subframe offse $T_{CSI-RS} / \Delta_{CSI-RS}$	t	Subframes	5 / 2	5 / 2		
CSI reference sig configuration	nal		0	3		
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap		Subframes / bitmap	3 / 0001000000000000000	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 allocative resource blocks (Noted to the second		PRB	50	50		
Simultaneous transmission			No	Yes (Note 3, 5)		
PDSCH transmiss mode	sion		9	9		
Note 1: $P_B = 1$ .Note 2:The mode port 7 or 8Note 3:Modulatic port (7 orNote 4:These ph virtual UE OCNG PI	ote 1: $P_B = 1$ .ote 2:The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.ote 3:Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.					
			ties $n_{ m SCID}$ are set to 0 neous transmission test			

#### 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	relation 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: The reference channel applies to both the input signal under test and the interfering signal.								

## 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	nce 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 model			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	CodeBookSubsetRestriction bitmap		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 for CQI reporting			PUSCH(Note 8)	N/A
cqi-pmi-ConfigurationIndex			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			OCNG Propagation Pattern Conditions		Correlatio n Matrix	Reference Va	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	ow 70		≥1	
Note 1:							lly 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:							ly 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	$\rho_{\scriptscriptstyle B}$	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 8.3.1.1B-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 $T_{\text{CSI-RS}} / \Delta_{\text{CSI-R}}$	et	Subframes	5/2	N/A	N/A	
CSI reference sig configuration			8	N/A	N/A	
Zero-power CSI- configuration ICSI-RS / ZeroPow bitmap		Subframes / bitmap	3 / 0010000000000 00	N/A	N/A	
ABS pattern (Not	e 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 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:	
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		Value	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	OP.1	OP.1		EVA5		2x2 Low	70	7.8	≥2
		FDD	FDD	FDD							
Note 1:	The propagat	ion condi	tions for	Cell 1, Co	ell 2 and	Cell 3 are	e statistic	ally independent	t.		
Note 2:	The correlation	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									
Note 3:	SNR correspo	onds to $\hat{I}$	$\hat{E}_s / N_{oc2}$ of	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

par	motor	Unit	Test 1			
para	parameter		Cell 1	Cell 2		
	$ ho_{\scriptscriptstyle A}$	dB	0	0		
Downlink	$ ho_{\scriptscriptstyle B}$ dB		0 (Note 1)	0		
power allocation	σ	dB	-3	-3		
anocation	PDSCH_RA	dB	4	NA		
	PDSCH_RB	dB	4	NA		

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	Pattern Condition		-	Correlation Matrix and	Reference value		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
Develiates	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
unooutorr	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	(Note 2)
	RS 0 antenna ports		NA	Port {15,16}
<i>qcl-CSI-RS-Configl</i> CSI-RS 0 period subframe offset <i>T</i> <sub>CSI</sub>	icity and ₋ <sub>RS</sub> / ∆ <sub>CSI-RS</sub>	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	nfiguration		NA	2/ 000001000000000
$N_{\scriptscriptstyle oc}$ 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>		MHz	10	10
Cyclic Pref	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 betwo	een TPs	μs	NA	Reference point in Table 8.3.1.3.1-3
Frequency error be	tween TPs	Hz	NA	0
Beamforming I	nodel		NA	Port 7 as specified in clause B.4.1
Symbols for unus	ed PRBs		NA	OCNG (Note 3)
Note 1: $P_B = 1$				
Noet 2: REs for a Note 3: These ph with one	ysical resou PDSCH per	rce blocks are virtual UE; the	zero transmission powe assigned to an arbitrary data transmitted over th n data, which is QPSK r	number of virtual UEs e OCNG PDSCHs

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 h	whothesis for each POI set
Table 0.5.1.5.1-2 Configurations of Fight and DE transmission f	Typollicals for cach r wi act

PQI set index	Parameter	s in each PQI set	hypothesi	smission is for each I 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 Number	Reference Channel						iCN tern	Time offset between	Propa Cond (No	tions	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 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:	The correlation	FDD       FDD         The propagation conditions for TP 1 and TP 2 are statistically independent.         The correlation matrix and antenna configuration apply for TP 1 and TP 2.         SNR corresponds to $\hat{E}_s / N_{oc}$ of TP 2 as defined in clause 8.1.1.												

#### Table 8.3.1.3.1-3: Minimum performance for quasi co-location type B: same Cell ID

### 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 power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	0
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Table 8.3.1.3.2-1: Test Parameters for timing offset compensation with DPS transmission

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/ 0010000000000000000000000000000000000	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	OC Pat	NG tern	Propagation Conditions		Correlation Matrix and	Reference	Reference Value	
			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:	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 both TP 1 and TP 2 as defined in clause 8.1.1.									

#### 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.

Table 8.3.1.3.3-1 Te	est Parameters for qua	asi co-location ty	pe B with differer	t Cell ID and Colliding CRS
----------------------	------------------------	--------------------	--------------------	-----------------------------

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	5/2	
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)	
with one PDSCH per	virtual UE; the	assigned to an arbitrary data transmitted over th n data, which is QPSK r	e OCNG PDSCHs	

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:	Note 1:       The propagation conditions for TP 1 and TP 2 are statistically independent.         Note 2:       Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.									

### 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			
Downlink power 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	ort	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	value	UE
nı	umber	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.

Pa	arameter		Unit	Test 1	Test 2	Test 3	Test 4	Test 5		
Downlin	k power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0		
	k power ation	$ 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		
	ecific referenc signals	е		Antenna port 0 and antenna port 1						
Beamfe	orming model					Annex B.4.1				
$N_{oc}$ at	$N_{oc}$ at antenna port dBm/15			-98	-98	-98	-98	-98		
Symbols f	Symbols for unused PRBs			OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)		
Simultane	Simultaneous transmission				No	No	Yes (Note 3, 5)	Yes (Note 3, 5)		
PDSCH tra	ansmission m	ode		8	8	8	8	8		
Note 2: T Note 3: M ir Note 4: T	Note 1: $P_B = 1$ .Note 2:The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.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.									
Note 5: T		scram	modulated. bling identities hission test cas	beib	t to 0 for CDN	<i>I</i> -multiplexed	DM RS with ir	terfering		

 Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

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.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 Category
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	/laximum (dB) hroughput	
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 unde	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 $T_{CSI-RS} / \Delta_{CSI-RS}$	t	Subframes	5 / 4	5 / 4			
CSI reference signal configuration			1	3			
Zero-power CSI-RS configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS 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			
mode       o         Note 1: $P_B = 1$ .         Note 2:       The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.         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.         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.							
			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	OCNG	Propagation	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	UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of SNR Maximum (dB) Throughput (%)		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 name	$ 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	•		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 configuratio			0	N/A
$N_{_{oc}}$ at antenna	a port	dBm/15kH z	-98	N/A
DIP (Note 2	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	model		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 me	ode		PUCCH 1-1	N/A
CodeBookSubsetR bitmap	Restriction		0000000000000000 0000000000000000 000000	N/A
Symbols for unuse	ed PRBs		OCNG (Note 6)	N/A
Simultaneous tran	smission		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
Note 1: $P_B = 1$ Note 2: The respective $N_{oc}$ ' is c Note 3: The mode	ective receive 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	Pattern Conditions		•	Correlatio n Matrix	Reference V	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:							lly independent.			
Note 2:	SINR corres	SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.								
Note 3:	Correlation	matrix ar	nd antenr	na configu	uration pa	arameters appl	ly 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 8.3.2.1C-2, with the addition of parameters in Table 8.3.2.1C-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 8.3.2.1C-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	
Uplink downlink Conf	iguration		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)	
anooanon	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	
$\hat{E}_s/N_{oc2}$		dB	Reference Value in Table 8.3.2.1C-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	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			Antenna ports 15,16	N/A	N/A	
CSI-RS periodicity subframe offs $T_{CSI-RS} / \Delta_{CSI-R}$	et	Subframes	5 / 4	N/A	N/A	
CSI reference si configuration			8	N/A	N/A	
Zero-power CSI configuration I <sub>CSI-RS</sub> / ZeroPowe bitmap	l	Subframes / bitmap	4 / 0010000000000 00	N/A	N/A	
ABS pattern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001	
RLM/RRM Measur Subframe Pattern (			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	
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 8.3.2.1C-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 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.
	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.
Note 14:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

#### Table 8.3.2.1C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Test Number	Reference Channel	OCNG Pattern				Propagation Conditions (Note1)		Correlation Matrix and	Reference Value		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:	$\begin{array}{                                    $										

### 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 ar 1	nd antenna port
Beamforn model			Annex	B.4.2
$N_{oc}$ at antenna port		dBm/15kHz	-98	-98
Symbols unused P			OCNG (Note 2)	OCNG (Note 2)
Number allocate resource b	ed	PRB	50	50
PDSCI transmiss mode	sion		8	8
Note 1:	$P_{R} = 1$			
Note 2:	These numbe transm	physical resource blocks or of virtual UEs with one hitted over the OCNG PD n data, which is QPSK m	PDSCH per virtual SCHs shall be unco	UE; the data

#### 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		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.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

par	motor	Unit	Test 1				
parameter		Unit	Cell 1	Cell 2			
	$ ho_{\scriptscriptstyle A}$	dB	0	0			
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0			
power allocation	σ	dB	-3	-3			
allocation	PDSCH_RA	dB	4	NA			
	PDSCH_RB	dB	4	NA			

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				
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 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	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	R.51 TDD	OP.1	N/A	ETU5	ETU5	2x2 Low	70	14.8	2-8
	16QAM 1/2		TDD							
Note 2:	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.									

# 8.3.2.4 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
Deverlight gewon	Downlink power $\rho_A$		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 antenr	na ports		NA	Port {15,16}
<i>qcl-CSI-RS-Configl</i> CSI-RS 0 period subframe offset <i>T</i> <sub>CSI</sub>	icity and $_{-RS} / \Delta_{CSI-RS}$	Subframes	NA	5/4
qcI-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	4/ 0000010000000000
$N_{\scriptscriptstyle oc}$ at antenn	a port	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>		MHz	10	10
Cyclic Pref	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 betwo	een TPs	μs	NA	Reference point in Table 8.3.2.4.1-3
Frequency error be	tween TPs	Hz	NA	0
Beamforming I	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 qua	asi co-location type B: same Cell ID
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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	hypothesi	smission s for each 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	offset Cor		opagation Correlation onditions Matrix and (Note1) 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 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 matrix and antenna configuration apply for TP 1 and TP 2.									
Note 3:	SNR correspo	nds to $\hat{I}$	$\dot{E}_s / N_{oc}$	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	parameter		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 mode	1		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific referer	ice signals		Antenna ports 0,1	(Note 2)
CSI reference signa			Antenna ports {15,16}	N/A
CSI-RS 0 periodicity subframe offset T <sub>CS</sub>	$_{I-RS}$ / $\Delta_{CSI-RS}$	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 periodicity subframe offset T <sub>CS</sub>	I-RS / $\Delta_{CSI-RS}$	Subframes	N/A	5 / 4
CSI reference signa configuration			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
$N_{oc}$ at antenna por	t	dBm/15kH z	-98	-98
BW <sub>Channel</sub>		MHz	10	10
Cyclic Prefix			Normal	Normal
Cell Id			0	0
Number of control C symbols	DFDM		2	2
Timing offset betwe	en TPs		N/A	Reference Value in Table 8.3.2.4.2-3
Frequency offset be		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	I PRBs		OCNG (Note 4)	OCNG (Note 4)
			zero transmission powe	

### 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	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						

#### 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	-			agation Correlation ditions 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:	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 $\hat{E}_s/N_{ac}$ of both TP 1 and TP 2 as defined in clause 8.1.1.									

# 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 $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$	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
$N_{_{oc}}$ 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			
Downlink power	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
	$N_{oc3}$	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 Measureme Pattern (Note			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 10111011 10111011 11111011	N/A
Number of control OF	DM symbols		3	3
PHICH Ng (No			1	N/A
PHICH durat			Extended	N/A
Unused RE-s and			OCNG	OCNG
overlapping wi	oplied in OFDM s th the aggressor	 symbols #1, #2, #3, #5, ABS. symbols #0, #4, #7, #11		
aggressor ABS Note 3: This noise is a Note 4: ABS pattern as	5. oplied in all OFDI s defined in [9]. P I in the serving ce	M symbols of a subfram DCCH/PCFICH other the ell subframe when the s	ne overlapping with ag nan that associated wi	gressor non-ABS th SIB1/Paging
Note 5: Time-domain n [7];	neasurement res	ource restriction pattern		
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			

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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 corresp	ponds to $ \widehat{E}_s $	$/N_{oc2}$ of	f 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
$\widehat{E}_{s}/N_{oc}$		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 (I	Note 4)		N/A	0001000000 0100000010 0000001000 0000000
RLM/RRM Measuren Pattern (No			000100000 010000010 000001000 000000000	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 1111110111 111111	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 dura			extended	N/A
Unused RE-s ar			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		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	5-1 FDD OP.1 OP.1 EVA5 EVA5 2x2 Low 1 -4.2 FDD FDD FDD						-4.2
Note 1:		e propagation conditions for Cell 1 and Cell2 are statistically independent.							
Note 2:	SNR corres	SNR corresponds to $\hat{E}_s/N_{oc2}$ 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 <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 8.4.1.2.4-2	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	C <sub>CSI,0</sub>		00000100 00000100 00000100 00000100 00000100	N/A	N/A
Sets (Note 6)	C <sub>CSI,1</sub>		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			Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic	orefix		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	•		OCNG Pattern Propagation Conditions (Note 1)		Correlation 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 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.2
Note 1: Note 2: Note 3:	<ul> <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> </ul>								·		

Paran	neter	Unit	Cell 1	Cell 2	Cell 3	
Downlink nowor	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3	
Downlink power 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	
$\widehat{E}_s/N_{oc2}$		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 Normal	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	00	NG Patte	Conditions (Note 1)				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	-2.0
Note 1: Note 2: Note 3:	The propagation The correlation SNR correspo	n matrix and a	ntenna co	onfiguratio							

# 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	•		0	0
(Note	1			
Special subframe	•		4	4
(Note 2	/		-	
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
Doumlink nouse	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 speci	fied in Table 4.2	2-2 in TS 36.211 [4	].	-
		2-1 in TS 36.211 4		
Note 3: Accordin	g 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	e value
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>e 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>e 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>e 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>e 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>e 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</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	Configuration	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 correspo	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 (Note 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 of a subframe overlapping with the aggressor 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 se and Cell2 is the		is the aggressor cell. The	ne number of the CR	S ports in Cell1	
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	Propage Condition		Correlation Matrix and	Reference Value	
			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 conf	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.

Parar	neter	Unit	Cell 1	Cell 2	Cell 3	
Uplink downlin		•••••	1	1	1	
Special subfram			4	4	4	
Downlink power	PDČCH_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	
$\widehat{E}_{s}/i$	•	dB	Reference Value in Table 8.4.2.2.4-2	5	3	
BWc	nannel	MHz	10	10	10	
Subframe C	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 Id			0	126	1	
ABS patter	ABS pattern (Note 4)		N/A	0000000001 00000000001	0000000001 0000000001	
RLM/RRM M Subframe Pat			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 sym			2	Note 7	Note 7	
ACK/NACK fe			Multiplexing	N/A	N/A	
PHICH Ng			1	N/A	N/A	
PHICH	duration		Normal	N/A	N/A	
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG	
Cyclic	prefix		Normal	Normal	Normal	
<ul> <li>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.</li> <li>Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>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</li> </ul>						
<ul> <li>subframe of aggressor cell.</li> <li>Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];</li> <li>Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];</li> </ul>						
indicat	ed by "0" of ABS p	battern.			upirame	
		ports in Cell1, Cell2 tted in Cell2 and Ce		ame.		
	ling to Clause 6.9		an o in the lest.			
NULE TU. AUCUIL	ing to Clause 0.9	III I O OU.Z I I [4].				

Test Number	Aggregati on Level	Reference Channel	00	NG Patte	ern	Propagation Conditions (Note 1)				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 $\hat{E}_s/N_{oc2}$ of cell 1.										

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Param	neter	Unit	Cell 1	Cell 2	Cell 3		
Uplink downlink			1	1	1		
Special subfram	e configuration		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	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	N/A		
port	N <sub>oc3</sub>	dBm/15kHz	-93 (Note 3)	N/A	N/A		
$\widehat{E}_s/N$	l <sub>oc2</sub>	dB	Reference Value in Table 8.4.2.2.4-4	5	3		
BW <sub>Cr</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 patter	· · · ·		N/A	0000000001 0000000001	0000000001 0000000001		
RLM/RRM M Subframe Pat			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 Subfra (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			Normal	N/A	N/A		
Unused RE-s			OCNG	OCNG	OCNG		
Cyclic				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.							
Note 5: Time-de [7].	omain measureme	ent resource restriction					
measur Note 7: MBSFN	Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].						
Note 8: The nur	mber of control OF	DM symbols is not	available for ABS a	and is 2 for the su	ubframe		
Note 9: Cell 1 is	ed by "0" of ABS parts the serving cell. the same.	attern. Cell 2 is the aggress	or cell. The numbe	er of the CRS por	rts in Cell1 and		
Note 10: SIB-1 w		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	00	NG Patt	ern		ropagatio itions (N		Correlation Matrix and	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	-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 aligned with A.3.6.
Unused RE-s	and PRB-s		OCNG	OCNG
Cell ID $N_{oc}$ at antenna port           Cyclic prefix			0	0
		dBm/15kHz	-98	-98
			Normal	Normal
Note 1: accordin	g 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	

Table 8.5.1.1-1:	Minimum	performance	PHICH
	WIIIIIIIII	periornance	

## 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: Minimum	performance PHICH
----------------------------	-------------------

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Reference 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	Reference 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	$N_{oc1}$	dBm/15kHz	-100.5 (Note 1)	N/A			
	N <sub>oc2</sub>	dBm/15kHz	-98 (Note 2)	N/A			
	$N_{oc3}$	dBm/15kHz	-95.3 (Note 3)	N/A			
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 8.5.1.2.3- 2	1.5			
BW <sub>Channe</sub>	1	MHz	10	10			
Subframe Config	guration		Non-MBSFN	Non-MBSFN			
Time Offset betwe	een Cells	μs	2.5 (synchron	ous 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 (No PHICH dura			1 extended	N/A N/A			
Unused RE-s an			extended OCNG	OCNG			
Cyclic pref			Normal	Normal			
<ul> <li>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</li> <li>Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS</li> <li>Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>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.</li> <li>Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]</li> <li>Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]</li> </ul>							
Cell2 is the sa Note 8: SIB-1 will not b			e number of the CRS p	oorts in Cell1 and			

Test Number	Reference Channel	OCNG	Pattern	rn Propagati Conditior (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 FDD	OP.1 FDD	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 an	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.

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           ABS pattern (Note 4)         N/A         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> 11111011 C <sub>CSI,1</sub> N/A         N/A           Image: Note 6         11111011 11111011         N/A         N/A           Image: Note 6         11111011 00000100         N/A         N/A           Image: Note 6         11111011 11111011         N/A         N/A           Image: Note 7         Note 7         Note 7         Note 7           PHICH Ng (Note 10)         1         N/A         N/A	Param	eter	Unit	Cell 1	Cell 2	Cell 3
allocation         POCH_RB PHICH_RB OCNG_RB         dB         -3         -3         -3           N <sub>ac</sub> at antenna port         N <sub>ac1</sub> dBm/15kHz         -98 (Note 1)         N/A         N/A           N <sub>ac2</sub> dBm/15kHz         -98 (Note 2)         N/A         N/A           N <sub>ac2</sub> dBm/15kHz         -98 (Note 2)         N/A         N/A           N <sub>ac2</sub> dBm/15kHz         -98 (Note 2)         N/A         N/A           BW <sub>Channel</sub> MHz         -93 (Note 3)         N/A         N/A           BW <sub>Channel</sub> MHz         10         10         10           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         10         00000100         00000100           ABS pattern (Note 4)         N/A         3.6.         00000100         00000100         00000100         00000100         00000100         00000100         00000100         00000100         00000100         000000100         000000100         0	Downlink power	PHICH_RA OCNG_RA	dB	-3	-3	-3
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		PDCCH_RB PHICH_RB	dB	-3	-3	-3
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		$N_{oc1}$	dBm/15kHz	-98 (Note 1)	N/A	N/A
			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         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           ABS pattern (Note 4)         N/A         00000100         00000100         00000100           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100         00000100         00000100         00000100           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> C <sub>CSI,1</sub> 111111011         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7         Note 7	$\widehat{E}_s/N$		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 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           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 11111011 C <sub>CSI,1</sub> 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         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           ABS pattern (Note 4)         N/A         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 Ng (Note 10)         1         N/A         N/A	Subframe Co	nfiguration		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           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100         N/A         N/A         N/A           CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 011111011 11111011         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 Ng (Note 10)         1         N/A         N/A	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         N/A         N/A           RLM/RRM Measurement Subframe Pattern (Note 5)         00000100 00000100 00000100         N/A         N/A         N/A           Ccsl,0         00000100 00000100         00000100 00000100         N/A         N/A           Ccsl,0         00000100 00000100         N/A         N/A           Ccsl,0         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	Frequency shift	between Cells	Hz	N/A	300	-100
PDCCH Content         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           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> 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	Cell	ld		0	126	1
ABS pattern (Note 4)         N/A         00000100 00000100 00000100 00000100 00000100 00000100 00000100         00000100 00000100 00000100           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> 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	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> 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	ABS pattern (Note 4)				00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100
CSI Subframe Sets (Note 6)         C <sub>CSI,0</sub> 00000100 00000100 00000100         N/A         N/A           CSI Subframe Sets (Note 6)         11111011 C <sub>CSI,1</sub> N/A         N/A         N/A           11111011 11111011 11111011         N/A         N/A         N/A           Number of control OFDM symbols         2         Note 7         Note 7           PHICH Ng (Note 10)         1         N/A         N/A				00000100 00000100 00000100		
Sets (Note 6)         11111011         N/A         N/A           C <sub>CSI,1</sub> 11111011         N/A         N/A           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	CSI Subframe	C <sub>CSI,0</sub>		00000100 00000100 00000100 00000100	N/A	N/A
Number of control OFDM symbols         2         Note 7         Note 7           PHICH Ng (Note 10)         1         N/A         N/A	Sets (Note 6)	C <sub>CSI,1</sub>		11111011 11111011 11111011 11111011 11111011	N/A	N/A
DILICITAtion Newson Newson Newson		· /		•		
				Normal	N/A	N/A
Unused RE-s and PRB-s         OCNG         OCNG           Cyclic prefix         Normal         Normal						

Table 8.5.1.2.4-1: Test Parameters for PHICH
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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	OCNG Pattern		Propagation Conditions (Note 1)				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:	<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>									

# 8.5.2 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)	nfiguration (Note		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			Grant should be included with the per information 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 p			Normal	Normal			
ACK/NACK fee			Multiplexing	Multiplexing			
Note 2: as specified in Table 4.2-1 in TS 36.211 [4]							
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	OCNG	Propagation	Antenna	Reference value	
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
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 number	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and correlation Matrix	Referen Pm-an (%)	ce value SNR (dB)
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 2 Medium	0.1	6.2

#### Table 8.5.2.2-1: 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.

	Paramete	r	Unit	Cell 1	Cell 2	
Upli	ink downlink cor	nfiguration		1	1	
Spec	cial subframe co	onfiguration		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 <sub>oc1</sub>	dBm/15kHz	-100.5 (Note 1)	N/A	
$N_{oc}$ at a	antenna port	$N_{oc2}$	dBm/15kHz	-98 (Note 2)	N/A	
		$N_{oc3}$	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>	I	MHz	10	10	
S	Subframe Config	guration		Non-MBSFN	Non-MBSFN	
Tir	me Offset betwe	en Cells	μs	2.5 (synchron	ous cells)	
Cell Id			0	1		
	ABS pattern (N	ote 4)		N/A	0000010001 0000000001	
RLM/R	RLM/RRM Measurement Subframe Pattern (Note 5)			000000001 0000000001	N/A	
CSI Su	bframe Sets	C <sub>CSI,0</sub>		0000010001 0000000001	N/A	
٩)	Note 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			1	N/A	
	PHICH dura	tion		extended	N/A	
U	nused RE-s and	d PRB-s		OCNG	OCNG	
	Cyclic pref			Normal	Normal	
Note 1: Note 2:	overlapping wi	th the aggressor pplied in OFDM s	ÁBS	#6, #8, #9, #10,#12, #1 of a subframe overlapp		
Note 3:			symbols of a subframe of	overlapping with addres	sor non-ABS	
Note 3:This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABSNote 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 subframe 5						
Note 5:				n for PCell measuremen		
Note 6:	As configured	according to the s	time-domain measurem	nent resource restriction	pattern for CSI	
Note 7:		erving cell. Cell 2	is the aggressor cell. T	he number of the CRS p	ports in Cell1 and	
Note 8: Note 9:		be transmitted in Clause 6.9 in TS 3				

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 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 correspor	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.	

Table 8.5.2.2.4-1: Test Parameters for PHICH
--

Test Number	Reference Channel	OCNG Pattern		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 TDD	OP.1 TDD	OP.1 TDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.7
Note 1: Note 2: Note 3:	The correlation	propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. corresponds to $\hat{E}_x/N_{ac2}$ 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	PBCH_RA	dB	0	-3
allocation			0	-3
$N_{\it oc}$ at anter	na port	dBm/15kHz	-98	-98
Cyclic pr	efix		Normal	Normal
Cell I	)		0	0
		-2 in TS 36.211 [4 -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	Referen	ce 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	Referen	ce 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		
Γ	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.

Paran	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 ant	enna port	dBm/15kHz	-98	N/A	N/A
$\frac{\hat{E}_{i}}{N_{c}}$	e e	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 Patter	m (Note 4)		N/A	01000000 01000000 01000000 01000000 01000000	01000000 01000000 01000000 01000000 01000000
Unused RE-s	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	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 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 corresponds to $\hat{E}_s / N_{oc}$ of cell 1.							

# 8.6.2 TDD

Parame	ter	Unit	Single antenna port	Transmit diversity			
Uplink downlink c (Note 2			1	1			
Special subframe (Note 2	•		4	4			
Downlink power allocation	PBCH_RA PBCH RB	dB dB	0 0	-3 -3			
$N_{oc}$ at antenna 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].							

## 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.

ĺ	Test	Bandwidth	Reference	Propagation	Antenna	Reference 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		
		PBCH_RA OCNG_RA	dB	-3	-3	-3		
allocati	allocation PBCH_RB OCNG_RB		dB	-3	-3	-3		
No	$_{c}$ at ante	enna port	dBm/15kHz	-98	N/A	N/A		
$\frac{\widehat{E}_s}{N_{os}}$			dB	Reference Value in Table 8.6.2.2.3-2	4	2		
BW <sub>Channel</sub>			MHz	1.4	1.4	1.4		
Time C	Offset be	tween Cells	μs	N/A	3	-1		
Frequen	cy shift b	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 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.								
,								

### Table 8.6.2.2.3-1: Test Parameters for PBCH

Test	Reference	Propagation Conditions (Note 1)		Antenna Configuration	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 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 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	Transmission	Antenna	Codebook	Downlink power allocation (dB)			$\hat{E}_{_{s}}$ at	Symbols for
Test	(MHz)	mode	configuration	subset -		$ 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
ЗA	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

### Table 8.7.1-2: test parameters for sustained downlink data rate (FDD)

Note 1: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.

## 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:	71112 bits for sub-frame 5.		
Note 4:	The TB success rate is defined as TB succes		
	the number of newly transmitted DL transport		nsmitted 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
Cinala	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: Note 2: Note 3: Note 4:	For non-CA UE, test is selected for maximum supported bandwidth. Void. If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single 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.

<b>D</b>	11.14	N/ I				
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 power locati (dB)	r	$\hat{E}_s$ at antenna port (dBm/15kHz)	ACK/NACK feedback mode	Symbols for unused PRBs
					$O_A$	$ ho_{\scriptscriptstyle B}$	σ	(abili/15knz)		
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 con	nfig	Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
		10	1	2	-	-	-	-
Single ca	arrier	15	-	-	ЗA	3A	-	-
		20	-	-	3	4	6	6
CA with 2	2CCs	20+20		-	3 (Note 4)	4 (Note 4)	6A	6A
Note 2: Note 3:	Note 2: For non-CA UE, test is selected for maximum supported bandwidth. Note 3: Void.							
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		1
sets		1
EPDCCH transmission		Localized
type		Localized
Number of PRB per		2 PRB pairs
EPDCCH set and		10MHz BW: Resource blocks $n_{PRB} = 48, 49$
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 CFI (i.e. default behaviour)
Symbol		Derived from CFT (i.e. derault behaviour)
ECCE Aggregation		2 ECCEs
Level		2 ECCES
Number of EREGs per		4
ECCE		4
EPDCCH scheduling		EPDCCH candidate is randomly assigned
C C		in each subframe
EPDCCH precoder		Fixed PMI 0
(Note 1)		
EPDCCH monitoring SF		111111111 000000000
pattern		111111111 000000000
Timing advance	μs	100
Propagation condition		Static propagation condition
		No external noise sources are applied
	oder parameters are	defined for tests with 2 x 2 antenna
configuration		

Table 8.7.3-1: Common te	est 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		Downlink power allocation (dB)				$\hat{E}_{_{s}}$ at	Symbols for
Test	(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					
ЗA	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:	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	ectly received DL transport blocks.						
Note 5:	52752 bits for sub-frame 5.	· ·						

Table 8.7.3-3	: Minimum rec	quirement (FDD)
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Table 8.7.3-4: Test point	ts 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	
Cinala	10	1	2	3A	3A	-	-	
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 (T	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 confiqu	Codebook subset	Downlink power allocation (dB)				$\hat{E}_{_{s}}$ at antenna port	Symbols for unused	ACK/NACK feedback
	(1411 12)	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)

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	R.31E-1 TDD	95				
2	25456/0	R.31E-2 TDD	95				
3 51024/0		R.31E-3 TDD	95				
3A 51024/0		R.31E-3A TDD	85				
4	75376/0 (Note 2)	R.31E-4 TDD	85				
6	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 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
Cingle	10	1	2	-	-	-	-
Single carrier	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	Unit	Value		
	PDCCH syn	nbols	symbols	2 (Note 1)	
PHICH dur				Normal	
Unused RE	-s and PRB		OCNG		
Cell ID			0		
		$ ho_{\scriptscriptstyle A}$	dB	-3	
Downlink p	ower	$ ho_{\scriptscriptstyle B}$	dB	-3	
allocation		σ	dB	0	
		δ	dB	3	
$N_{oc}$ at ante	enna port	dBm/15 kHz	-98		
Cyclic prefi	х		Normal		
Subframe (	Configuratio		Non-MBSFN		
Dragadar I	Indata Cran	ulority	PRB	1	
Flecodel C	Jpdate Gran	ulanty	ms	1	
Beamformi	ng Pre-Code	er		Annex B. 4.4	
Cell Specif	ic Reference	e Signal		Port 0 and 1	
Number of	EPDCCH S	ets Configured		2 (Note 2)	
Number of	PRB per EF	PDCCH Set		4 (1 <sup>st</sup> Set) 8 (2 <sup>nd</sup> Set)	
EPDCCH S	Subframe Mo	onitoring		NA	
PDSCH TN	Λ			TM3	
DCI Forma	t			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	Aggregatio	Reference	OCNG	Propagation	Antenna	Reference 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		OCNG	
Cell ID			0	
CONTE		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	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)
<ul> <li>Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is n 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 PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set EPDCCH is scheduled in the first set for Test 1 and set set for Test 2, respectively. Both sets are always conf Note 3: Demodulation performance is averaged over normal special subframe.</li> </ul>				

 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	e 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.

	Parame	eter	Unit	Value
Number of PD	CCH syr	nbols	symbols	1 (Note 1)
EPDCCH starting symbol			symbols	2 (Note 1)
PHICH duration				Normal
Unused RE-s	and PRE	-s		OCNG
Cell ID		-		0
		$ ho_{\scriptscriptstyle A}$	dB	0
Downlink pow	er	$ ho_{\scriptscriptstyle B}$	dB	0
allocation		σ	dB	-3
		δ	dB	0
$N_{\scriptscriptstyle oc}$ at antenr	na port		dBm/15 kHz	-98
Cyclic prefix				Normal
Subframe Cor	nfiguratio	n		Non-MBSFN
Precoder Upd	ata Gran	ularity	PRB	1
Frecoder Opd	ale Gian	ulanty	ms	1
Beamforming				Annex B.4.5
Cell Specific F				Port 0 and 1
CSI-RS Refer				Port 15 and 16
CSI-RS refere	ence sign	al resource		0
configuration				5
CSI reference		ubframe		2
configuration				_
ZP-CSI-RS co				000001000000000
	ubframe o	configuration I <sub>ZP-</sub>		2
CSI-RS Number of EP		oto		2 (Note 2)
		onitoring pattern		<u>2 (Note 2)</u> 111111110 11111101 111111011
subframePatte				111110111 (Note 3)
PDSCH TM	onnoonnig	, , , , , , , , , , , , , , , , , , , ,		TM9
	starting	symbol for EPDC	CH is signalle	d with epdcch-StartSymbol-r11. However, CFI is
	to 1.			
		is distributed trans	mission with	PRB = {0, 49} and the second set is localized
				5, 42, 49}. ePDCCH is scheduled in the second set
	all tests.			· · · · ·
				equired to monitor ePDCCH for UE-specific search
spa	ace only i	n SFs configured b	y subframeP	atternConfig-r11. Legacy PDCCH is not scheduled.

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.

Table 8.8.2.1-2: Minimum	performance Localized EPDCCH with TM9

Test	Bandwidt	Aggregatio	Reference	OCNG	Propagatio	Antenna	Referenc	e 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.

Parame	eter	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
$N_{ac}$ at antenna port	-	dBm/15	-98
		kHz	
Cyclic prefix			Normal
Subframe Configuratio	n		Non-MBSFN
Precoder Update Gran	ularity	PRB	1
•	-	ms	1
Beamforming Pre-Code			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sig			Port 15 and 16
CSI-RS reference sign configuration	al resource		0
CSI reference signal su	ubframe		0
configuration I <sub>CSI-RS</sub>			0
ZP-CSI-RS configuration	on bitmap		000001000000000
ZP-CSI-RS subframe of	configuration $I_{ZP-}$		0
CSI-RS Number of EPDCCH S	oto		2 (Note 2)
EPDCCH Subframe Me subframePatternConfig	onitoring pattern		1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)
PDSCH TM			TM9
TDD UL/DL Configurat	ion		0
TDD OL/DL Conliguiat			1 (Note 4)
			d with epdcch-StartSymbol-r11. However, CFI is
set to 1.	Symbol IOI EFDCC	an is signalle	
Note 2: The first set	PRB = {0, 49} and the second set is localized 5, 42, 49}. ePDCCH is scheduled in the second set		
Note 3: EPDCCH is space only i	n SFs configured by	y subframeP	equired to monitor ePDCCH for UE-specific search PatternConfig-r11. Legacy PDCCH is not scheduled.
Note 4: Demodulation	on performance is a	veraged ove	r 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

De		Unit	Τe	est 1	Te	st 2			
-	irameter	Unit	TP 1	TP 2	TP 1	TP 2			
PHICH durat					ormal				
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0				
power	$ ho_{\scriptscriptstyle B}$	dB			0				
allocation	σ	dB			-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 8.8.3.1- 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-PR (setConfigId)			0	1	0	1			
PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized			
Number of P EPDCCH-PR	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 transmission mode PDSCH transmission scheduling		TM10 Blanked in all the subframes	TM10 Transmit in all the subframes	TM10 Probability of occurrence of PDSCH transmission is 30% (Note 3)	TM10 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 <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 offs	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 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:									

Table 8.8.3.1-2: Minimum Performance

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

_			Те	est 1	Tes	st 2			
Parameter		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	σ	dB			-3				
	δ	dB		1	0	1			
$\hat{E}_s/N_{oc}$		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.2- 2	Reference value in Table 8.8.3.2- 2	Reference value in Table 8.8.3.2- 2			
$N_{\scriptscriptstyle oc}$ at anten	na port	dBm/ 15kH z		-	98				
Bandwidth		MHz	10	10	10	10			
Number of E	PDCCH Sets		2 (N	lote 1)	2 (N	ote1)			
EPDCCH-PR (setConfigId)			0	1	0	1			
PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized			
Number of P EPDCCH-PR	B-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 configuration	s		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 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	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			

PQI set 0	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1		
(Note 4)	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 o	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		
TDD UL/D	DL configuration		0					
TDD spec	ial subframe				1			
Note 1:		= 0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.						
Note 2:	The starting OFDM sy And CFI is set to 1.			-				
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		

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	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 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	Test 1 Test 2		est 2			
Bandwidth		MHz	MHz 10					
PDSCH transmissio	on mode		1					
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0					
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0					
	σ	dB			0			
Propagation condit antenna configur			AWGN (1 x 2)					
SNR (Note 2	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					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) and the respective wanted signal input level.								

#### 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.

Parameter		Unit	Те	st 1	Tes	st 2	
Bandwidth		MHz			10		
PDSCH transmission mode					1		
Uplink downlink cont	figuration			2			
Special subfra					4		
configuration	<u>1</u>				4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB			0		
allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
	σ	dB			0		
Propagation condit antenna configu				AWG	N (1 x 2)		
SNR (Note 2		dB	0	1	6	7	
$\hat{I}_{or}^{(j)}$		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		PUSCH (Note 3)				
PUCCH Report	Туре		4				
Reporting period		ms	$N_{\rm pd} = 5$				
cqi-pmi-Configurati				ľ	3		
ACK/NACK feedbac				Mult	iplexing		
Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.							
<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</li> </ul>							
		JCCH. PDCCH DCI QI to multiplex with					

## 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 (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  $C_{CSI,1}$  shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Parameter		Unit		Tes				st 2	
			Cel		Cell 2	Ce	ell 1	Cell 2	
Bandwidth PDSCH transmissio		MHz	2	1(	Note 10		1 2	0 Note 10	
F DOCIT (I anomiosi		dB	2	-3				3	
Downlink power	$\rho_{A}$								
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3				3	
Dranagation condi	σ	dB		0				0	
Propagation condi antenna configu	ration		C	Clause B	3.1 (2x2)		Clause I	B.1 (2x2)	
$\widehat{E}_{_{s}}/N_{_{oc2}}$ (No	te 1)	dB	4	5	6	4	5	-12	
( <i>i</i> )	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (N	lote 7)	N/A		lote 7)	N/A	
$N_{\scriptscriptstyle oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	ote 8)	N/A	-98(N	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (N	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			0		1		0	1	
Time Offset betwee	en Cells	μs	2.5	(synchro	nous cells)	2.5	i (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 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>		01010 01010 01010 01010 01010	0101 0101 0101 0101 0101	N/A	0101 0101 0101 0101	01010101 01010101 01010101 N/A 01010101 01 01010101		
(Note 3)	C <sub>CSI,1</sub>		1010 <sup>-</sup> 1010 <sup>-</sup> 1010 <sup>-</sup> 1010 <sup>-</sup> 1010 <sup>-</sup> 1010 <sup>-</sup>	1010 1010 1010 1010 1010	N/A	1010 1010 1010 1010	)1010 )1010 )1010 )1010 )1010 )1010	N/A	
Number of control symbols	OFDM			3			;	3	
Max number of HARQ transmissions				1				1	
Physical channel for C <sub>CSI,0</sub> CQI reporting			Р	UCCH F	Format 2		PUCCH	Format 2	
Physical channel for C <sub>CSI,1</sub> CQI reporting			Р	USCH (	Note 12)		PUSCH	(Note 12)	
PUCCH Report	Туре			4				4	
Reporting perio	dicity	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-Configuration C <sub>CSI,1</sub> (Note 1	onIndex2		5		N/A		5	N/A	

## Table 9.2.1.3-1: 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 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.5.1.5
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:	
Note 14:	cqi-pmi-ConfigurationIndex2 is applied for C <sub>CSI,1</sub>

## 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 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 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		11		Tes	st 1		Те	st 2	
Parameter		Unit	Ce	ll 1	Cell 2	Ce	ll 1	Cell 2	
Bandwidth		MHz			0	10		-	
PDSCH transmission			2	2	Note 10		2	Note 10	
Uplink downlink cont					1			1	
Special subfra configuration				4	1			4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-	3		-	3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-	3		-	3	
	σ	dB		(	)			0	
Propagation condit antenna configu				Clause E	3.1 (2x2)		Clause	B.1 (2x2)	
$\widehat{E}_{s}/N_{oc2}$ (Not	e 1)	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	
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-94	-93	-92	-94 -93 -11		-110	
Subframe Configu	uration		Non-M	IBSFN	Non-MBSFN	Non-N	IBSFN	Non-MBSFN	
Cell Id			(	)	1	(	0	1	
Time Offset betwee	en Cells	μs	2.5 (synchr		2.5 (synchronous cells)		2.5 (synchronous cells		onous cells)
ABS pattern (No	ote 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	10001	N/A	01000	)10001 )10001	N.A	
(Note 3)	C <sub>CSI,1</sub>		10001	01000	N/A	1000101000		N/A	
Number of control	OFDM		1000101000			10001			
symbols	0. 2			:	3			3	
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 reporting			I	PUSCH	(Note 12)		PU	SCH	
PUCCH Report Type				4	4			4	
Reporting period		ms			= 5	1		= 5	
cqi-pmi-Configurati			3		N/A		3	N/A	
C <sub>CSI,0</sub> (Note 1				)	IN/A		5	IN/A	
cqi-pmi-Configuratio C <sub>CSI,1</sub> (Note 1			2	1	N/A		4	N/A	
ACK/NACK feedba				Multip	lexing		Multip	lexing	

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		st 1		st 2
			Cell 1	Cell 2 and 3	Cell 1	Cell 2 and 3
Bandwidth	n modo	MHz		0		0 Note 10
PDSCH transmission		dB	2	Note 10 3	2	3
Downlink power	$ ho_{\scriptscriptstyle A}$	-		-		-
allocation	$ ho_{\scriptscriptstyle B}$	dB	-	3		3
Dranagation condit	σ	dB	(	)	(	0
Propagation condit antenna configu			Clause E	3.1 (2x2)	Clause I	3.1 (2x2)
$\widehat{E}_{s}/N_{oc2}$ (Not		dB	4 5	Cell 2: 12	13 14	Cell 2: 12
$L_s/Iv_{oc2}$ (Not		GD		Cell 3: 10		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
pon	$N_{oc3}^{(j)}$	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	0	Cell 2: 6
			Cell 2:	Cell 3: 1 3 usec	Cell 2:	Cell 3: 1 3 usec
Time Offset betwee	en Cells	μs		-1usec		-1usec
Frequency Shift betw	een Cells	Hz		300Hz	Cell 2: 300Hz	
		1.12	Cell 3:	-100Hz	Cell 3:	-100Hz
ABS pattern (Note 2)			N/A	01010101 01010101 01010101 01010101 01010101 01010101	N/A	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 10101010	N/A	10101010 10101010 10101010 10101010 10101010 10101010	N/A
Number of control symbols	OFDM		ć	3	:	3
Max number of H transmission			,	1		1
Physical channel for C <sub>CSI,0</sub> CQI			PUCCH	PUCCH Format 2		Format 2
Physical channel for C <sub>CSI,1</sub> CQI			PUSCH	(Note 12)	PUSCH	(Note 12)
reporting PUCCH Report	Туре			4		4
Reporting period		Ms		= 5	N <sub>pd</sub>	= 5
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1	onIndex		6	N/A	6	N/A
cqi-pmi-Configuratio	onIndex2		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:	cqi-pmi-ConfigurationIndex is applied for C <sub>CSI.0</sub>
Note 14:	cqi-pmi-ConfigurationIndex2 is applied for C <sub>CSI,1</sub>

# 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.

_				Tes	st 1		Te	st 2
Parameter		Unit	Ce		Cell 2 and 3	Ce		Cell 2 and 3
Bandwidth		MHz		1	0		1	0
PDSCH transmission	on mode			2	Note 10		2	Note 10
Uplink downlink configuration					1			1
Special subfra configuratio				2	4	4		4
Downlink power $\rho_A$ allocation $\rho_B$		dB		-	3		-	3
		dB		-	3		-	3
	σ	dB		(	0		(	0
Propagation condi antenna configu				Clause I	B.1 (2x2)		Clause I	B.1 (2x2)
$\widehat{E}_{s}/N_{oc2}$ (No		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	10           2         Not           1         1           4         -3           -3         0           Clause B.1 (2x2)           13         14           -98 (Note 7)         N           -98 (Note 8)         N           -98 (Note 9)         N           -93 (Note 9)         N           Non-MBSFN         Non-N           0         Cell 2: 3 usec           Cell 3: -1usec         Cell 3: -1usec           Cell 2: 300Hz         Cell 3: -100Hz           1         N/A         01000           0000000001         N           010001         N           0100010001         N           10001010001         N           1000101000         N           1000101000         N <t< td=""><td>N/A</td></t<>	N/A	
Subframe Config	uration		Non-M	1BSFN	Non-MBSFN	Non-MBSFN		Non-MBSFN
Cell Id			(	C	Cell 2: 6 Cell 3: 1			Cell 2: 6 Cell 3: 1
Time Offset betwee	en Cells	μs			3 usec -1usec	Cell 2: 3 usec		3 usec
Frequency shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz		Cell 2: 300Hz		300Hz	
ABS pattern (No	ote 2)		N/A		0100010001 0100010001	N/A		0100010001 0100010001
RLM/RRM Measu Subframe Pattern			00000		N/A			N/A
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 01000		N/A			N.A
(Note 3)	C <sub>CSI,1</sub>			01000 01000	N/A			N/A
Number of control symbols	OFDM			:	3		:	3
Max number of H transmission					1			1
Physical channel for reporting	C <sub>CSI,0</sub> CQI			PUCCH	Format 2		PUCCH	Format 2
Physical channel for C <sub>CSI,1</sub> CQI reporting				PUSCH	(Note 12)		PUSCH	(Note 12)
PUCCH Report Type			4				4	
Reporting periodicity		ms		Npd	= 5		Npd	= 5
cqi-pmi-Configurati C <sub>CSI,0</sub> (Note 1	ionIndex		3	3	N/A			N/A
cqi-pmi-Configuratio	onIndex2		4	4	N/A		4	N/A
ACK/NACK feedba	ck mode		1	Multip	lexing		Multip	lexing

Table 9.2.1.6-1: PUCCH	1-0 static test (TDD)
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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 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 CQI to multiplex with the HARQ-ACK on PUSCH in unlink outforms SF#9 and #3
Noto 12:	CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
Note 13:	
Note 14:	cai-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	Test 2				
Bandwidth									
PDSCH transmission	on mode		4						
$\rho_A$		dB	-3						
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3						
	σ	dB		0					
Propagation condit antenna configu				Clause B.1 (2 x 2)					
CodeBookSubsetRestriction bitmap				01	0000				
SNR (Note 2	<u>2)</u>	dB	10	11	16	17			
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-88	-87	-82 -8				
$N_{oc}^{(j)}$		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)				
Note 1:Reference measurement channel 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 2:For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s)									
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	Test 2			
	Bandwidth		MHz		,	10			
PDSCH	transmissic	on mode				4			
	wnlink conf					2			
Special subframe configuration					4				
Downlin	k power	$ ho_{\scriptscriptstyle A}$	dB			-3			
	Downlink power $\rho_{B}$		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		
	$N_{oc}^{(j)}$		dB[mW/15kHz] -98 -98			98			
	number of H					1			
	ansmission					•			
Physical	channel for reporting	CQI/PMI		PUSCH (Note 3)					
PUC	CH Report	Туре				2			
	orting period		ms	$N_{\rm pd} = 5$					
	-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 PDSCH transmission mode		MHz			10		
PDS	SCH transmissi	on mode				9		
		$ ho_{\scriptscriptstyle A}$	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 in 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	-98		
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	on mode				9		
Uplink downlink con					2		
Special subframe co	nfiguration				4		
	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	$P_c$	dB			-6		
	σ	dB			-3		
CRS reference s					ports 0, 1		
CSI reference si	gnals			Antenna po	orts 15,,22		
CSI-RS periodicity an offset <i>T</i> <sub>CSI-RS</sub> / Δ <sub>CSI-</sub>				5	i/ 3		
CSI reference signal c					0		
Propagation condition	and antenna			Clause I	B.1 (8 x 2)		
configuratio Beamforming M				As specified i	n Section B.4.	3	
CodeBookSubsetRestr					0000 0000 000		
SNR (Note 2		dB	4	5	10	11	
$\hat{I}_{or}^{(j)}$	· · · ·		-94	-93	-88	-87	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-9	-98	
Max number of HARQ t	ransmissions				1		
Physical channel for				DUCCI			
reporting				PUSCE	I (Note 3)		
PUCCH Report Type fo PMI	r CQI/second			:	2b		
Physical channel for F	RI reporting			PU	SCH		
PUCCH Report Type fo					5		
Reporting perio	dicity	ms		Np	d = 5		
CQI delay		ms		10	or 11		
cqi-pmi-Configurat	ionIndex				3		
ri-ConfigInde				805 (	Note 4)		
ACK/NACK feedba					plexing		
Note 1: Reference m	easurement ch	annel RC.7 TDD ac	cording to Ta	ble A.4-1 with	one sided dyr	namic OCNG	
Note 2: For each test respective wa	, the minimum anted signal inp		be fulfilled for			. ,	
PUSCH inste	ad of PUCCH.	CQI/PMI reports an PDCCH DCI forma outtiplex with the HA	t 0 shall be tra	ansmitted in d	lownlink SF#3	and #8 to	
Note 4: RI reporting i RI, CQI/PMI a CQI/PMI repo	nterval is set to and HARQ-AC orts will be drop	the maximum allow K reports. In the cas oped, while RI and F every 160ms during	vable length o se when all th HARQ-ACK w	of 160ms to m ree reports co rill be multiple	inimise collisio ollide, it is expe	ons between ected that	

## 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			
Bandwidth		MHz	TP1	TP		0 TP1	TF	2	
						0			
. 2001 (1010)110	$\rho_A$	dB	0	0		0	ſ	)	
Downlink power		dB	0	0		0			
PDSCH transmis         Downlink power         allocation (Note 1)         Cell ID         Cell-specific reference         CSI reference         CSI-RS period         subframe offset To         CSI-RS config         Zero-Power O         configurat         ICSI-RS / ZeroPow         bitmap         CSI-IM config         ICSI-RS / ZeroPow         bitmap         CSI-IM config         ICSI-RS / ZeroPow         bitmap         CSI-IN config         ICSI-RS / ZeroPow         bitmap         CSI-IN config         ICSI-RS / ZeroPow         bitmap         CSI-IN config         ICSI-RS / ZeroPow         bitmap         CSI process corr         Signal/Interference         mode         Propagation con         antenna config         CodeBookSubset         bitmap         SNR (Note $\hat{I}_{or}^{(j)}$ Noculation / Info         payload	$ ho_{\scriptscriptstyle B}$ Pc	dB	-3	-3		-3			
( )	Ρ <sub>c</sub> σ	dB	-3			-3	TP2           0		
Call ID		UD UD	-5		~			Λ	
Cell ID			-	,		-	0 Antenna ports (Note 2)		
Cell-specific refere	ence signals		Antenna ports 0, 1	(Note	e 2)	0, 1	(Not	e 2)	
	-		Antenna ports 15,,18	N/.	A	Antenna ports 15,,18	N/	Ά	
			5/1	N/.	A	5/1	N/	Ά	
-			0	N/.	A	0	N/	Ά	
configurat I <sub>CSI-RS</sub> / ZeroPow bitmap	ion verCSI-RS		1 / 00100000000 0000	1 100000 000	00000	1 / 00100000000 0000	100000	00000	
CSI-IM configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS			1 / 00100000000 0000	N/A		1 / 00100000000 0000	N/A		
CSI process configuration Signal/Interference/Reporting			CSI-RS/CSI-IN	M/PUCCH 1-1		CSI-RS/CSI-IM/PUCCH		H 1-1	
Propagation condition and			Clause B.1	Clause		Clause B.1	Clause B.1		
antenna configuration CodeBookSubsetRestriction			(4 x 2) 0x0000 0000	(2 x 1000		(4 x 2) 0x0000 0000	(2 X 2) 100000		
		dB	0100 0000 20	6	7	0100 0000 20		15	
,	= 3)								
		dB[mW/15kHz]	-78	-92	-91	-78		-83	
		dB[mW/15kHz]	-98		-98				
payload	k		(Note4)	QPSK / 4392		(Note4)	QPSK / 4392		
Max number o transmissi			1	N/A		N/A 1		N/A	
Physical channel f reportin			PUSCH (Note5)	N/.	A	PUSCH (Note5)		N/A	
PUCCH Report CQI/PM	Type for		2	N/	A	2	N/A		
PUCCH Report			3	N/.	A	3	N/	Ά	
Reporting per	iodicity	ms	$N_{\rm pd} = 5$	N/.		$N_{\rm pd} = 5$			
CQI Delay		ms	8	N/.		8			
cqi-pmi-Configur			2	N/.		2			
ri-ConfigIn PDSCH scheduled			1,2,3,4,	N/.	А	1		A	
Timing offset bet		us	1,2,3,4,			1,2,3,4,			
Frequency offset b		Hz							
Note1:Reference OP.1 FDNote 2:REs for aNote 3:For each	e measureme D as describe antenna ports (	nt channel RC.10 d in Annex A.5.1.1 0 and 1 CRS have num requirements	zero transmission	power.					
	colligions hot			V it in no	000005	to report both on F			

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	or.	Unit	Tes	st 1		Tes	st 2	
			TP1 TP2 TP1 TP2					2
Bandwidt		MHz	<u> </u>					
PDSCH transmiss Uplink downlink co								
Special subframe co					2 4			
$\rho_A$		dB	0	0		-	(	<u>ן</u>
Downlink power			_	-		_		-
allocation (Note 1)	$\rho_{\scriptscriptstyle B}$	-		-				
	Pc	Clause B.1         Clause B.1         Clause B.1         Clause B.1         Clause B.1           (8 x 2)         (2 x 2)         (8 x 2)         (2 x 2)           0x0000 0000         0x0000 0000         0x20 0000						
	σ	aв			A			/A
Cell ID			-	)		-	)	
Cell-specific referen	nce signals		0, 1	(Not	e 2)	0, 1	(Not	te 2)
CSI reference	signals			N/	A		N	/A
CSI-RS periodic subframe offset Tcs			5/3	N/	A	5/3	N	/A
CSI-RS config			0	N/	A	0	N	/A
Zero-Power C configurati I <sub>CSI-RS</sub> / ZeroPowe bitmap	on		00100000000	100001	00000	00100000000	100001	100000
CSI-IM configuration I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap			00100000000	N/A		00100000000	N/A	
CSI process configuration Signal/Interference/Reporting mode			CSI-RS/CSI-IM/PUCCH 1-1			CSI-RS/CSI-IM/PUCCH 1-1		┨ 1-1
Propagation condition and antenna configuration						(8 x 2)		
CodeBookSubsetI bitmap	Restriction		0x0000 0000 0020 0000 0000 0001 0000	100000		0020 0000		000
SNR (Note	3)	dB	17	6	7	17	14	15
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-81	-92	-91	-81	-84	-83
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	1		-9	98	
Modulation / Infor payload			(Note4)	QPSK / 4392		(Note4)	QPSK / 4392	
Max number of transmissic	ons		1	N/	A	1	N	/A
Physical channel for reporting	)		PUSCH (Note5)	N/	A	PUSCH (Note5)	N	/A
PUCCH Report CQI/second	PMI		2b	N/		2b		/A
Physical channel for RI reporting			PUSCH	N/	A	PUSCH	N	/A
PUCCH Report Type for RI/ first PMI			5	N/		5		/A
Reporting peri		ms	$N_{\rm pd} = 5$	N/		$N_{\rm pd} = 5$		/A
CQI Delay cqi-pmi-ConfigurationIndex		ms	10 or 11 3	N/ N/		10 or 11 3		/A /A
ri-ConfigIn			805 (Note 6)	N/		805 (Note 6)		/A /A
ACK/NACK feedb			Multiplexing	N/		Multiplexing		/A
PDSCH scheduled			3,4,		-	3,4,		-
Timing offset betw		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	st 1	Te	st 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	
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-6	98	
_			Clause	B.2.4 wi	th $\tau_d = 0$	).45 <i>μ</i> s,	
Propagation channel					$T_D = 5 \text{ Hz}$		
	configuration		1 x 2				
Reporti	ng interval	ms		5			
CQ	l delay	ms	8				
	ing mode		PUSCH 3-0				
	and size	RB	6 (full size)				
	per of HARQ		1				
	nissions						
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: R w A	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.				ribed in		
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.							

#### Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	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.

Parameter		Unit	Те	st 1	Tes	st 2	
Band	lwidth	MHz		10	MHz		
Transmission mode				1 (p	ort 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0		
power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	allocation $\sigma$		0				
	downlink uration				2		
	subframe uration				4		
SNR (	Note 3)	dB	9	10	14	15	
$\hat{I}_{a}$	(j) or	dB[mW/15kHz]	-89	-88	-84	-83	
N	oc	dB[mW/15kHz]	-98 -98			8	
			Clause B.2.4 with			1	
Propagatio	on channel		$ au_{d}=0.45\mu\mathrm{s}$ , a = 1,			1,	
				$f_D = 5 \mathrm{Hz}$			
	onfiguration				x 2		
	g interval	ms	5				
	delay	ms	10 or 11				
	ng mode		PUSCH 3-0				
	and size	RB	6 (full size)				
	er of HARQ iissions				1		
			Multiplexing				
ACK/NACK feedback mode       Multiplexing         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		
with in A	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.					cribed	
Note 3: For each test, the minimum requirements shall be fulfilled for at lea one of the two SNR(s) and the respective wanted signal input level							

Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (T	וחם־
Table 9.5.1.1.2-1 Sub-band lest for single antenna transmission (1	נטט

Table 9.3.1.1.2-2 Minimum requirement (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			est 2	
Bandwidth		MHz	Cel	l <b>i 1</b> 1(	Cell 2 and 3	Cell 1	Cell 2 and 3	
PDSCH transmission mode			1		Note 10	1	Note 10	
$\rho_A$		dB		0			0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		0			0	
anocation	σ	dB		0			0	
Propagation condition			Clause with Td us, a = 5 H	= 0.45 1, fd =	EVA5 Low antenna correlation	Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz	EVA5 Low antenna correlation	
Antenna configu	ration			1x		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	
()	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	ote 7)	N/A	-98 (Note 7)	N/A	
$N_{\scriptscriptstyle oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	ote 8)	N/A	-98 (Note 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (N	ote 9)	N/A	-93 (Note 9)	N/A	
Subframe Config	uration		Non-M	BSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN	
Cell Id			C	)	Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1	
Time Offset betwee	en Cells	μs		Cell 2: 3 Cell 3: -		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/		01010101 01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101 01010101	
RLM/RRM Measurement Subframe Pattern (Note 4)			00000 00000 00000 00000 00000	0100 0100 0100	N/A	00000100 00000100 00000100 00000100 00000100	N/A	
C <sub>CSI,0</sub>			0101 0101 0101 0101 0101 0101	0101 0101 0101 0101 0101	N/A	01010101 01010101 01010101 01010101 01010101 01010101	N/A	
(Note 3)	C <sub>CSI,1</sub>		1010 1010 1010 1010 1010 1010	1010 1010 1010 1010	N/A	10101010 10101010 10101010 10101010 10101010 10101010	N/A	
Number of control OFDM symbols				3		3		
Max number of HARQ transmissions				1			1	
CQI delay		ms			3	3		
Reporting interval (Note 13)		ms			1	0		
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		Tes		Test 2			
			Cel		Cell 2 and 3	Ce		Cell 2 and 3	
Bandwidth		MHz		1			1	0	
PDSCH transmission mode			1		Note 10	1		Note 10	
Uplink downlink configuration					1			1	
Special subframe configuration				2	1	4			
	$ ho_{\scriptscriptstyle A}$	dB		(	)		(	)	
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB		(	)		0		
anooution	σ	dB		(	)	0			
Propagation condition			Clause with Td us, a = 5 H	= 0.45 1, fd =	EVA5 Low antenna correlation	Clause with Td us, a = 5 I	= 0.45 1, fd =	EVA5 Low antenna correlation	
Antenna configuratio	n			1)			1:	k2	
$\widehat{E}_{s} \big/ N_{oc2}$ (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	ote 7)	N/A	-98 (N	ote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	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)			N/	A	0100010001 0100010001	N	/A	0100010001 0100010001	
RLM/RRM Measuren Subframe Pattern (N			000000		N/A	00000 00000		N/A	
CSI Subframe Sets	C <sub>CSI,0</sub>		01000 <sup>-</sup> 01000 <sup>-</sup>		N/A	01000 01000		N.A	
(Note 3)	C <sub>CSI,1</sub>		100010	01000	N/A	10001 10001	01000	N/A	
Number of control OFDM symbols			3		3	3			
Max number of HARQ transmissions					1			1	
CQI delay		ms			1	0			
Reporting interval (N	ote 13)	ms				0			
Reporting mode					PUSC	CH 3-0			
Sub-band size		RB	6 (full size)						
ACK/NACK feedback mode				Multip	lexing		Multip	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.

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. Sub-bands of a size smaller than full size are excluded from the test.

Para	meter	Unit			st 2		
Band	lwidth	MHz	10 MHz				
Transmis	sion 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	v(j) oc	dB[mW/15kHz]	-!	98	-6	98	
			Clause	Clause B.2.4 with $\tau_d = 0.45 \mu \text{s}$ ,			
Propagation	on channel			a=1, f	$f_D = 5 \text{ Hz}$		
Antenna co	onfiguration		2x2				
Beamforming Model			As specified in Section B.4.3			B.4.3	
CRS reference signals				Antenna ports 0			
CSI refere	nce signals Antenna ports 1		oorts 15, <sup>-</sup>	16			
	and subframe offset			5	/1		
T <sub>CSI-RS</sub>	$/\Delta_{CSI-RS}$			5	/ 1		
	signal configuration			4			
CodeBookSubsetRestriction bitmap			000001				
Reporting interval (Note 4)		ms	5				
	delay	ms	8				
Reporting mode			PUSCH 3-1				
Sub-band size		RB	6 (full size)				
Max number of HA				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)					opano		
Note 2: Reference measurement channel RC.8 FDD according to Table A.4					/two		
sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.							
						two	
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: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in dow			vnlink				
SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF							

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1

≥1

≥1

Table 9.3.1.2.1-2 Minimum	requirement (FDD)
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## 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

**UE** Category

- 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. Sub-bands of a size smaller than full size are excluded from the test.

Para	ameter	Unit Test 1 Test		st 2			
Bar	dwidth	MHz	10 MHz				
Transmi	ssion mode		9		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	B.2.4 wi	th $\tau_{J} = 0$	).45 μs,	
Propaga	tion channel			Clause B.2.4 with $\tau_d = 0.45 \mu\text{s}$ , $a = 1, f_D = 5 \text{Hz}$			
Antenna	Antenna configuration		2x2				
Beamforming Model			As sp	As specified in Section B.4.3			
CRS reference signals					na port 0		
CSI reference signals					port 15,1	6	
CSI-RS periodicity and subframe offset				5	/ 3		
	$_{\rm S}$ / $\Delta_{\rm CSI-RS}$			5	/ 3		
	signal configuration				4		
CodeBookSubsetRestriction bitmap			000001				
Reporting interval (Note 4)		ms	5				
CQ	l delay	ms	10				
	ing mode		PUSCH 3-1				
	and 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							
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.8 TDD according to						′two	
sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.							
Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two			two				
SNR(s) and the respective wanted signal input level.							
Note 4: PDCCH DCI format 0 with a trigger for aperiodic CC							
SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted			nsmitted	on uplink	SF#2 ar	nd #7.	

Table 9.3.1.2.2-1	Sub-band test for TDD

Table 9.3.1.2.2-2 Minimum	requirement (TDD)
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	Test 1	Test 2
α[%]	2	2
$\beta$ [%]	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	
	dwidth	MHz	10 MHz				
Transmis	sion mode		1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)		
power	$ ho_{\scriptscriptstyle B}$	dB		(	)		
allocation	σ	dB		(	)		
SNR	Note 3)	dB	6	7	12	13	
ĺ	(j) or	dB[mW/15kHz]	-92	-91	-86	-85	
Ν	$I_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-9	8	
Propagat	ion channel			EP	A5		
	ation and			High (	(1 x 2)		
	onfiguration				. ,		
	ng mode	ms			H 1-0		
	delay	ms			$\frac{N_{\rm pd}=2}{8}$		
	channel for	115					
	eporting		PUSCH (Note 4)				
	Report Type		4				
cqi-pmi-					1		
	ationIndex						
	er of HARQ				1		
	nissions	rta in an available u	unlink ron	orting inc	topoo ot		
<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 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</li> </ul>							
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.				rn OP.1 g to IG			
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.				CCH Ind #9			

Table 9.3.2.1.1-1 Fadin	g test for single	antenna (FDD)
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	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.

Parameter		Unit	Test 1 Test 2		st 2	
	dwidth	MHz			MHz	
Transmi	ssion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
	downlink guration				2	
	subframe guration			2	4	
	(Note 3)	dB	6	7	12	13
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-92	-91	-86	-85
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-6	98	-9	98
	tion channel			EP	A5	
	ation and			Lligh (	(1 x 2)	
	configuration					
	ing mode			PUCC		
	g periodicity	ms	$N_{\rm pd} = 5$			
CQI delay		ms	10 or 11			
Physical channel for CQI reporting			PUSCH (Note 4)			
	Report Type			4	4	
	i-pmi-				3	
Configu	rationIndex					
	ber of HARQ				1	
	missions CK feedback					
	ode			Multip	lexing	
Note 1:		rts in an available u	nlink ren	orting ins	tance at	
Note 1.		n based on CQI es				ot later
		, this reported wide				
		before SF#(n+4).				
Note 2:		easurement channel	RC.1 TE	DD accord	ding to Ta	able
	A.4-1 for Cate	gory 2-8 with one s	ided dyna	amic OCI	NG Patte	rn OP.1
		ibed in Annex A.5.2				
		or Category 1 with o				IG
		2 TDD as described				
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						
	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.						

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	st 1	Tes	st 2
Bandwidth		MHz	10 MHz			
Transmission mode				9	9	
	$ ho_{\scriptscriptstyle A}$	dB		(	C	
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		An	tenna po	rts 15,	,18
	and subframe offset				/1	
	$\Delta_{CSI-RS}$			5	/1	
CSI-RS reference s	signal configuration			2		
CodeBookSubset	Restriction bitmap		0x0	000 000	0 0000 0	001
Reportir	ng mode			PUCC	CH 1-1	
	periodicity	ms		$N_{pd}$	= 5	
CQI	delay	ms		8	3	
	nel for CQI/ PMI		PUSCH (Note 4)			
	rting			FUSCH	(NOLE 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					
	e measurement char					ne
	sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.					
		t, the minimum requirements shall be fulfilled for at least one of the two				
	SNR(s) and the respective wanted signal input level.					
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.						

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.

	Parar	neter	Unit	Tes	st 1	Te	st 2
	Bandwidth		MHz			MHz	
	Transmiss					9	
Uplir	nk downlin	k configuration				2	
Spec	ial subfram	ne configuration		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	ig mode		PUC		Sub-moc	le: 2)
	Reporting		ms		$N_{\rm pd} = 5$		
	CQI		ms		1	0	
Phys	sical chann repo	el for CQI/ PMI			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
		th on PUSCH instead					
	transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.					with the	
Note 5:	RI reporti	ng interval is set to th	ne maximum allowa	ble length			
	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						
		CK will be multiplexed					
	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						
		dropping) is available		Jasnand	a		

Table 9.3.2.2.2-1	Fading	test for	TDD
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	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  $\geq \gamma$ ;

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. Sub-bands of a size smaller than full size are excluded from the test.

Para	meter	Unit	Test 1	Test 2
Bandwidth		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
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-94
Max number of HARQ transmissions			1	
			Clause B.2.4 with $\tau_d=0.45\mu$	
Propagati	on channel		$a = 1, f_D = 5 \text{ Hz}$	
Reportin	ng interval	ms	5	
	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 A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as</li> </ul>				llink subframe ideband CQI n+4) ding to Table
		e/two sided dynamic .nnex A.5.1.1/2.	OUNG Pattern C	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

Table 9.3.3.1.1-2	Minimum red	quirement (	(FDD)
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## 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  $\geq \gamma$ ;

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. Sub-bands of a size smaller than full size are excluded from the test.

Para	Parameter Unit Test 1 Test 2					
Ban	dwidth	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	<sup>.</sup> RB 05	dB[mW/15kHz]	-102	-93		
$I_{\scriptscriptstyle ot}^{(j)}$ for	RB 641	dB[mW/15kHz]	-93	-93		
$I_{\scriptscriptstyle ot}^{(j)}$ for	RB 4249	dB[mW/15kHz]	-93 -102			
ĺ	r(j) or	dB[mW/15kHz]	/15kHz] -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 o	onfiguration		1 x	2		
	ng interval	ms	5			
CQI	delay	ms	10 o			
Report	ing mode		PUSC	H 3-0		
	and size	RB	6 (full size)			
ACK/NACK feedback mode			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.

Par	ameter	Unit	Test 1 Test 2		st 2	
Bandwidth		MHz		10 N	ИНz	
Transmi	ssion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(	)	
power	$ ho_{\scriptscriptstyle B}$	dB	dB 0		)	
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,
Propaga	tion channel		$a = 1, f_D = 5 \text{ Hz}$			
Reporting interval		ms	5			
CQI 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	
<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> <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>					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.

Par	ameter					
Bandwidth		MHz		10 MHz		
Transmi	ssion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		(	)	
allocation	σ	dB		(	)	
confi	downlink guration		2			
	l subframe guration			2	4	
SNR	(Note 3)	dB	9	10	14	15
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-89	-88	-84	-83
Ì	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-6	98
			Clause	B.2.4 wit	th $\tau_{d} = 0$	).45 <i>μ</i> s,
Propagation channel			-			
Reporting interval		ms	$a = 1, \ f_D = 5 \text{ Hz}$			
	I delay	ms	10 or 11			
Repor	ting mode		PUSCH 2-0			
	ber of HARQ					
trans	missions				1	
Subba	nd size ( <i>k</i> )	RBs		3 (full	size)	
	of preferred ands ( <i>M</i> )			ţ	5	
	CK feedback					
n	node			Multip	lexing	
Note 1: Note 2: Note 3:	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) 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. 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 9.3.4.1.2-1 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.

Para	ameter	Unit	Tes	st 1	Tes	st 2
	dwidth	MHz	10 MHz			
	ssion mode			1 (po		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$\rho_{\scriptscriptstyle B}$	dB	0			
allocation	σ	dB	0			
SNR	(Note 3)	dB	8	9	13	14
	(j) or	dB[mW/15kHz]	-90	-89	-85	-84
	$V_{oc}^{(j)}$	dB[mW/15kHz]	-9	98	-g	8
Propagat	ion channel				h $\tau_d = 0$	.45 μs,
Denentin				a = 1, f	$\frac{D}{D} = \frac{1}{2} \frac{1}{12}$	
	g periodicity I delay	ms ms		/VP	= ∠	
	channel for	1115			)	
	eporting			PUSCH	(Note 4)	
	Report Type			,	1	
	band CQI			2	ŧ	
	Report Type				1	
	band CQI per of HARQ					
	nissions			1	I	
	nd size (k)	RBs		6 (full	size)	
	of bandwidth				/	
ра	rts (J)					
	K				1	
	ConfigIndex		1			
Note 1:	subframe SF# not later than	orts in an available u #n based on CQI es SF#(n-4), this repor blied at the eNB dov	timation a ted subb	at a down and or wi	link subfi deband (	
Note 2:		easurement channe				
		e/two sided dynamic	COCNG I	Pattern O	P.1/2 FD	D as
Note 3:		Annex A.5.1.1/2. , the minimum requi	rements (	shall he fi	ulfilled for	rat
14010-0.		ne two SNR(s) and t				
	level.				<b>J</b>	
Note 4:		sions between CQI				
			eport both on PUSCH instead of PUCCH. PDCCH			
		shall be transmitted dic CQI to multiplex				
		rame SF#5, #7, #1 a				J3СП
Note 5:			t subband (having 2RBs in the last			
bandwidth part) are to be disregarded and data scheduling						
		he most recent subl	band CQ	l report fo	or bandwi	dth part
Note C:	with j=1.		1	ad al-4- '		
Note 6:		here wideband CQI cording to the most				
	report.	cording to the most	recently t			

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

Table 9.3.4.2.1-2 Minimum requirement (FDD)
---

	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.

Parameter Unit Test 1 Test 2					st 2	
	dwidth	MHz	10 MHz			
Transmis	ssion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	σ	dB		(	)	
Uplink	downlink			,	2	
	guration			4	<u>_</u>	
	subframe		4			
	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			
pu	K		1			
cqi-pmi-(	ConfigIndex			3	3	
ACK/NAC	CK feedback		Multiplexing			
		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	isions between CQI reports and HARQ-ACK it is report both on PUSCH instead of PUCCH. PDCCH shall be transmitted in downlink SF#3 and #8 to allow to multiplex with the HARQ-ACK on PUSCH in uplink #7 and #2				CCH c allow
Note 5:	CQI reports for bandwidth paraccording to t with j=1.	or the short subband rt) are to be disrega he most recent subl	nd (having 2RBs in the last garded and data scheduling bband CQI report for bandwidth part			
Note 6:		here wideband CQI cording to the most				I

	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	
	ission mode	101112		ort 0)	
	lic 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		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	
	g periodicity	ms	$N_{\rm pd} = 2$	N/A	
	l delay	ms	8	N/A	
CQI	l channel for reporting		PUSCH (Note 3)	N/A	
	Report Type		4	N/A	
	qi-pmi- ırationIndex		1	N/A	
	ber of HARQ		1	N/A	
trans	missions	rts in an available	•	-	
<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 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> </ul>					
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. Note 4: The respective received power spectral density of each interfering cell relative to $N_{ac}$ is defined by its associated DIP value as					
<ul> <li>specified in clause B.5.1.</li> <li>Note 5: 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.</li> <li>Note 6: Both cells are time-synchronous.</li> </ul>					
Note 7:	Static channe Gaussian nois	l is used for the int se model Cell 2 is	erference model. not present.		
Note 8:	SINR corresp	onds to $ \widehat{E}_{_{s}} ig / N_{_{oc}}   $	of Cell 1 as defin	ed in clause	
Note 9:	<ul> <li>8.1.1.</li> <li>Note 9: Downlink physical channel setup in Cell 2 applies OCNG pattern OP.1 FDD as defined in Annex A.5.1.1.</li> </ul>			OCNG pattern	

 Table 9.3.5.1.1-1 Fading test for single antenna (FDD)

Table 9.3.5.1.1-2 Minimum requirement (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%.

-		11 14	<b>0</b> <i>i</i>	0.110		
	ameter	Unit	Cell 1	Cell 2		
	ndwidth	MHz		MHz		
	ission mode		1 (po	ort 0)		
	c downlink iguration			2		
	ll subframe					
	iguration		4	4		
	lic Prefix		Normal	Normal		
			0	1		
	R (Note 8)	dB	-2	N/A		
	· · · · ·					
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98		
	tion channel lation and		EPA5	Static (Note 7)		
	configuration		Low (1 x 2)	(1 x 2)		
	(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 PUSCH (Note	N/A		
-	I channel for		· · ·	N/A		
	reporting Report Type		3)	N/A		
	qi-pmi-					
Configu	ırationIndex		3	N/A		
	ber of HARQ		1	N/A		
transmissions ACK/NACK feedback						
	node		Multiplexing	N/A		
Note 1:						
eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to 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.						
<ul> <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> <li>Note 4: The respective received power spectral density of each interfering</li> </ul>						
Note 5:	cell relative to $N_{oc}$ is defined by its associated DIP value as specified in clause B.5.1.					
Note 5: Note 6: Note 7:	<ul><li>2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.</li><li>Note 6: Both cells are time-synchronous.</li></ul>					
Note 8:	SINR corresp	onds to $ {\widehat E}_{s} ig/ N_{oc}  {}^{\prime}$ (	of Cell 1 as define	d in clause		
Note 9:	8.1.1.			OCNG pattern		

Table 9.3.5.1.2-1 Fading test for single antenna (TDD)	

Table 9.3.5.1.2-2	Minimum rec	quirement	(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%.

<b>_</b>		<b>0</b> " 1	0	
Parameter Bandwidth	Unit MHz	Cell 1	Cell 2 MHz	
Transmission mode	IVIHZ		9	
Cyclic Prefix		Normal	9 Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-2	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A	
Propagation channel Correlation and		EPA5	Static (Note 7)	
antenna configuration		Low (2 x 2)	(1 x 2)	
DIP (Note 4)	dB	N/A	-0.41	
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0	
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and subframe offset		5/1	N/A	
CSI-RS reference		2	N/A	
signal configuration				
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 measurement channel		Note 2	N/A	
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 CQI/PMI reporting		PUSCH (Note 3)	N/A	
PUCCH Report Type for CQI/PMI		2	N/A	
PUCCH channel for RI reporting		PUCCH Format 2	N/A	
PUCCH Report Type for RI		3	N/A	
cqi-pmi-				
ConfigurationIndex		2	N/A	
ri-ConfigIndex		1	N/A	
Max number of HARQ		1	N/A	
transmissions			-	
<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 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.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.</li> </ul>				
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.				
-	tive received power spectral density of each interfering to $N_{ac}$ is defined by its associated DIP value as			
specified in cl Note 5: Two cells are		ch Cell 1 is the sei	rving cell and Cell	
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-	Fading	test for	single	antenna	(FDD)
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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.

Table 9.3.5.2.1-2 Minimum requirement (
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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%.

			0.114	0.110	
	rameter	Unit	Cell 1	Cell 2	
	ndwidth	MHz		MHz	
	ission mode k downlink			9	
	figuration		:	2	
	al subframe				
	figuration			4	
	lic Prefix		Normal	Normal	
	Cell ID		0	1	
	R (Note 8)	dB	-2	N/A	
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
		ub[IIIW/I5KI12]			
	ation channel		EPA5	Static (Note 7)	
	lation and		Low (2 x 2)	(1 x 2)	
	configuration	JD			
	(Note 4)	dB	N/A Antenna ports	-0.41	
	cific reference ignals		Antenna port 0		
			0,1 Antenna ports		
	rence signals		15,16	N/A	
	periodicity and		5/3	N/A	
	ame offset				
	S reference		2	N/A	
	onfiguration				
	figuration			3 /	
	CSI-RS /	Subframes /	N/A	001000000000	
	werCSI-RS	bitmap		0000	
	itmap				
	kSubsetRestr		001111	N/A	
ictio	n bitmap		001111	IN/A	
Re	ference		Note 2	N/A	
measurement channel				-	
	rting mode		PUCCH 1-1	N/A	
				N/A	
CQI delay ms 10 N/A					
	Physical channel for CQI/PMI reporting 3) N/A				
	Report Type		3)		
	CQI/PMI		2	N/A	
	channel for RI		PUCCH		
	porting		Format 2	N/A	
	Report Type			N1/A	
	for RI		3	N/A	
C	qi-pmi-		3	N/A	
	urationIndex				
	onfigIndex		805 (Note 9)	N/A	
	ber of HARQ		1	N/A	
	smissions		-		
	CK feedback		Multiplexing	N/A	
Note 1:	node	l orts in an available u		tance at	
Note 1.		th based on CQI es			
		, this reported wide			
		before SF#(n+4)			
Note 2:		easurement channel	RC.11 TDD acco	ording to Table	
		e sided dynamic OC			
	described in A	Annex A.5.2.1.			
Note 3:		sions between CQI/			
		report both on PUS			
		shall be transmitted			
		PMI to multiplex wit	n the HARQ-ACK	on PUSCH in	
Note 4:		ne SF#2 and #7. e received power sp	actral donaity of a	ach interfering	
11018 4.					
	cell relative to	$N_{\it oc}$ ´ is defined by	its associated DI	r value as	

Note 5:	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: Note 7:	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 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.

Table 9.3.5.2.2-2 Minimum requirement (TDD)
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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.

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. Sub-bands of a size smaller than full size are excluded from the test.

Parameter		l lucit	Unit Test 1					Test 2			
			TP	1	TI	2	TP1 TP2				
	lwidth	MHz			MHz		10 MHz				
Iransmiss	sion mode		10			0	10			0	
	$ ho_{\scriptscriptstyle A}$	dB			0		0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		(	0				0		
allocation	$P_c$	dB	-3		(	)	-3 0		C		
	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			-9	98		
Propagation channel			EPA 5 Low Clause B.2.4.1 with $\tau_d = 0.45 \mu s$ , $a = 1$ , $f_D = 5 \text{Hz}$		EPA 5 Low		$ au_d = 0$	B.2.4.1 ith 0.45 μs, = 1, = 5 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 15,	a ports		ports 0,1 N/A		Antenna Antenna ports 15,,18		/A	
	and subframe offset		5/1		N/A		5/1		N	/A	
T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub> CSI-RS 0 configuration			0		N/A		0		N	/A	
CSI-RS signal 1			N/A		Antenna ports 15,16		IN/A			a ports ,16	
CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$			N//	4	5/1		N/A		5	/1	
CSI-RS 1 configuration			N//	4		5	N/A			5	
	RS 0 configuration erCSI-RS bitmap		N//			/ 000000 00	N	/A	111000	/ 000000 00	
	RS 1 configuration rerCSI-RS bitmap		1 / 00100110000 00000		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/*	I	N	/A	5	/1	N	/A	
	onfiguration		6		N	/A	(	6	N	/A	
T <sub>CSI-RS</sub>	and subframe offset / $\Delta_{CSI-RS}$		N//	4	5/	/1	N	/A	5	/1	
CSI-IM 2 co	onfiguration		N//				N	/A		1	
	CSI-RS				RS 0				RS 0		
	CSI-IM Reporting mode						SI-IM 0 CCH 1-1				
	CodeBookSubsetR estriction bitmap		0x00		0 0000 0	001			00 0000 0001		
	Reporting periodicity	ms	N <sub>pd</sub> = 5			N <sub>pd</sub> = 5					
CSI process 0	CQI delay	ms		1	1			1	1		
	Physical channel for CQI/ PMI reporting				(Note 6)		PUSCH (Note 6)				
	PUCCH Report Type for CQI/PMI				2		2				
	PUCCH channel		F	UCCH	Format 2			PUCCH	Format 2		

	for RI reporting						
ł	PUCCH report						
	type for RI		3	3	3	5	
	cqi-pmi- ConfigurationIndex		2	1	4	Ļ	
	ri-ConfigIndex		2	2	2	)	
	CSI-RS		CSI-		CSI-I	RS 1	
	CSI-IM		CSI-	IM 0	CSI-	IM 0	
Ì	Reporting mode		PUSC	H 3-1	PUSC	H 3-1	
CSI process 1	CodeBookSubsetR estriction bitmap		000	001	000	001	
	Reporting interval (Note 10)	ms	5	5	5	5	
İ	CQI delay	ms	1	1	1		
	Sub-band size	RB	6 (full	size)	6 (full	size)	
	CSI-RS		CSI-I		CSI-F		
	CSI-IM		CSI-		CSI-		
	Reporting mode		PUSC	CH 3-1	PUSC	H 3-1	
CSI process 2 (For UE configured	CodeBookSubsetR estriction bitmap		0x0000 0000	0000 0001	0x0000 0000	0000 0001	
single process)	Reporting interval (Note 8)	ms	5	5	5	5	
İ	CQI delay	ms	8	3	8	}	
t	Sub-band size	RB	6 (full size	e) (Note 9)	6 (full size	) (Note 9)	
	CSI-RS		CSI-I		CSI-F		
t	CSI-IM		CSI-		CSI-		
	Reporting mode		PUSC		PUSC		
CSI process 2	CodeBookSubsetR						
(For UE configured	estriction bitmap		0x0000 0000	0000 0001	0x0000 0000	0000 0001	
multiple processes)	Reporting interval (Note 10)	ms	5	5	5		
	CQI delay	ms	1	1	1	1	
				ze) (Note 9)			
	CSI-RS	T(D)	CSI-I		CSI-F		
	CSI-IM		CSI-IM 2		CSI-IM 2		
	Reporting mode		PUSC			CH 3-1	
CSI process 3	CodeBookSubsetR estriction bitmap		000001		000001		
	Reporting interval	ms	5		5		
	(Note 10						
	CQI delay	ms	1		1		
	Sub-band size	RB	6 (full		6 (full		
CSI process for P			CSI pro		CSI pro		
Cel			0	6	0	6	
Quasi-co-loc	ated USI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1	
Quasi-co-lo	cated 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 subfr	ame 1 and 6		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000	
Max number of HA			1	N/A	1	N/A	
	eports in an available	uplink reporting insta d wideband CQI canr				downlink SF not	
later than	SF#(11-4), this reported				· /-		
Note 2: 3 symbols Note 3: Reference	allocated to PDCCH. measurement chann		ling to Table A.4-1	. PDSCH transmi	ssion is scheduled	l on subframe	
Note 2: 3 symbols Note 3: Reference 2, 3, 4, 7,	allocated to PDCCH. measurement chann 8 and 9 from TP1.	el RC.12 FDD accord	-			l on subframe	
Note 2: 3 symbols Note 3: Reference 2, 3, 4, 7, Note 4: TM10 OCI	allocated to PDCCH. measurement chann 8 and 9 from TP1. NG OP.8 FDD as spe	el RC.12 FDD accord	nsmitted on subfra	me 1 and 6 from	TP1.		
Note 2:3 symbolsNote 3:Reference2, 3, 4, 7,Note 4:TM10 OCINote 5:TM10 OCINote 6:To avoid co	allocated to PDCCH. measurement chann 8 and 9 from TP1. NG OP.8 FDD as spe NG OP.8 FDD as spe collisions between CQ	el RC.12 FDD accord cified in A.5.1.8 is trai cified in A.5.1.8 is trai I/PMI reports and HA	nsmitted on subfra nsmitted on subfra RQ-ACK it is nece	ume 1 and 6 from ume 1, 2, 3, 4, 6, 7 essary to report bo	TP1. 7, 8 and 9 from TP. oth on PUSCH inst	2 ead of PUCCH.	
Note 2:3 symbolsNote 3:Reference2, 3, 4, 7,Note 4:TM10 OCINote 5:TM10 OCINote 6:To avoid ofPDCCH DACK on P	allocated to PDCCH. measurement chann 8 and 9 from TP1. NG OP.8 FDD as spe NG OP.8 FDD as spe collisions between CQ OCI format 0 shall be tr USCH in uplink SF#2	el RC.12 FDD accord cified in A.5.1.8 is trai cified in A.5.1.8 is trai I/PMI reports and HA ransmitted in downlini and #7.	nsmitted on subfra nsmitted on subfra RQ-ACK it is nece k SF#3 and #8 to a	ime 1 and 6 from ime 1, 2, 3, 4, 6, 7 essary to report bo allow periodic CQ	TP1. 7, 8 and 9 from TP: oth on PUSCH inst I/PMI to multiplex v	2 ead of PUCCH. with the HARQ-	
Note 2:3 symbolsNote 3:Reference2, 3, 4, 7,Note 4:TM10 OCINote 5:TM10 OCINote 6:To avoid coPDCCH DoACK on PNote 7:For each tosignal input	a allocated to PDCCH. e measurement chann 8 and 9 from TP1. NG OP.8 FDD as spe NG OP.8 FDD as spe collisions between CQ OCI format 0 shall be tr USCH in uplink SF#2 test, the minimum requ at level.	el RC.12 FDD accord cified in A.5.1.8 is trai cified in A.5.1.8 is trai I/PMI reports and HA ransmitted in downlin and #7. uirements shall be ful	nsmitted on subfra nsmitted on subfra RQ-ACK it is nece k SF#3 and #8 to a filled for at least or	ame 1 and 6 from ame 1, 2, 3, 4, 6, 7 essary to report bo allow periodic CQ ne of the two SNR	TP1. 7, 8 and 9 from TP: oth on PUSCH inst I/PMI to multiplex v R(s) and the respec	2 ead of PUCCH. with the HARQ- ctive wanted	
Note 2:3 symbolsNote 3:Reference2, 3, 4, 7,Note 4:TM10 OCINote 5:TM10 OCINote 6:To avoid ofPDCCH DACK on PNote 7:For each tsignal inputNote 8:PDCCH DCQI/PMI/F	a allocated to PDCCH. e measurement chann 8 and 9 from TP1. NG OP.8 FDD as spe- NG OP.8 FDD as spe- collisions between CQ I format 0 shall be tr USCH in uplink SF#2 test, the minimum requ	el RC.12 FDD accord cified in A.5.1.8 is trai cified in A.5.1.8 is trai I/PMI reports and HA ransmitted in downlin and #7. uirements shall be ful- uger for aperiodic CQI uplink SF#0 and #5.	nsmitted on subfra nsmitted on subfra RQ-ACK it is nece k SF#3 and #8 to a filled for at least or shall be transmitte	ame 1 and 6 from ame 1, 2, 3, 4, 6, 7 essary to report bo allow periodic CQ me of the two SNR ed in downlink SF	TP1. 7, 8 and 9 from TP: oth on PUSCH inst I/PMI to multiplex v R(s) and the respect #1 and #6 to allow	2 ead of PUCCH. with the HARQ- ctive wanted	

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 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.

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. Sub-bands of a size smaller than full size are excluded from the test.

_				Te	st 1			Te	st 2	
Parameter		Unit	Т	TP1 TP2		TP1 TP2				
Bandwidth		MHz			MHz		10 MHz			
	Transmission mode			0	10		10			0
	nk configuration		2 4			<u>2</u> 1		2		2 4
Special subframe configuration		dB		-		ł	4		0	4
	$\rho_{\scriptscriptstyle A}$				0				-	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0				0	
allocation	P <sub>c</sub>	dB	-	3		)	-	3		0
	σ	dB	4.0		3				3	1 10
	Note 7)	dB	10	11	7	8	14	15	9	10
I	(j) or	dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88
N	r(j) oc	dB[mW/15kHz]		-6	98			-6	98	
					Clause					B.2.4.1
					wi					ith
Propagati	on channel		EPA	5 Low		.45 μs,	EPA	5 Low		).45 <i>μ</i> s,
					a = 1,					= 1,
						= 5 Hz			2	= 5 Hz
	onfiguration		4		22 Section			k2 ecified ir		x2
	ning Model between TPs	us	AS SP		0	D.4.3	AS SL			D.4.3
	et between TPs	Hz			0		0			
	ference signals		Antenna ports 0,1		Antenna ports 0,1					
CSI-RS signal 0			Antenna ports 15,, 18 N/A			a ports ., 18	N	/A		
	and subframe offset		5/3		N	/A	5/3		N	I/A
	$/\Delta_{CSI-RS}$		0 N/A		/^	0		N	/A	
CSI-RS 0 configuration				-		a ports		-		na ports
	signal 1		N/A 15, 16			N	/A		, 16	
	/ and subframe offset / $\Delta_{\rm CSI-RS}$		N	/A	5,	/3	N	/A	5	/3
CSI-RS 1 c	configuration		N	/A		5	N	/A		5
	RS 0 configuration /erCSI-RS bitmap		N		3 111000 000			/A	11100	3 / 000000 000
	RS 1 configuration /erCSI-RS bitmap		00100	/ 110000 000	N	/A	00100	/ 110000 000	N	I/A
	and subframe offset / $\Delta_{CSI-RS}$		5.	/3	5,	/3	5	/3	5	/3
	onfiguration			2		2		2		2
	and subframe offset / $\Delta_{CSI-RS}$		5,	/3	N	/A	5	/3	N	/A
	onfiguration		(	6	N	/A	(	6	N	/A
CSI-IM 2 periodicity	and subframe offset		N	/A		/3	N	/A		/3
	$/\Delta_{CSI-RS}$									
031-111/1 2 0	onfiguration CSI-RS		N		RS 0		IN.	/A CSI-	RS 0	1
	CSI-IM				-IM 0				-IM 0	
	Reporting mode				CH 1-1		PUCCH 1-1			
	CodeBookSubsetR estriction bitmap		0x0	000 000	0 0000 0	001	0x0000 0000 0000 0001		001	
CSI process 0	Reporting periodicity	ms		$N_{\rm pd}$	= 5		N <sub>pd</sub> = 5			
	CQI delay	ms		1	2			1	2	
	Physical channel for CQI/ PMI reporting				(Note 6)		PUSCH (Note 6)			
	PUCCH Report				2				2	
reconnepon					۷.					

# Table 9.3.6.2-1 Fading test for TDD

		Type for CQI/PMI					
		PUCCH channel		РИССН	Format 2	PUCCH	Format 2
		for RI reporting		roccii	r onnat z	rocen	r onnat z
		PUCCH report type for RI		:	3	3	3
		cqi-pmi- ConfigurationIndex		:	3	:	3
		ri-ConfigIndex		805 (N	ote 10)	805 (N	ote 10)
		CSI-RS		CSI-	RS 1	CSI-	
		CSI-IM			·IM 0	CSI-	
		Reporting mode		PUSC	CH 3-1	PUSC	H 3-1
CSI pro	cess 1	CodeBookSubsetR estriction bitmap		000001		000	001
		Reporting interval (Note 9)	ms	ę	5	Ę	5
		CQI delay	ms		2	1	2
		Sub-band size	RB	6 (ful	size)	6 (full	size)
		CSI-RS			RS 0	CSI-	RS 0
		CSI-IM		CSI-		CSI-	
		Reporting mode		PUSC		PUSC	H 3-1
CSI pro	cess 2	CodeBookSubsetR estriction bitmap		0x0000 000		0x0000 000	
Corpro		Reporting interval (Note 9)	ms	:	5	Ę	5
		CQI delay	ms	1	2	1	2
		Sub-band size	RB	6 (full size	=	6 (full size	
		CSI-RS	ND ND	CSI-	RS 1	CSI-	
		CSI-IM			·IM 2	CSI-	
	•	Reporting mode			H 3-1	PUSCH 3-1	
		CodeBookSubsetR					
CSI pro	cess 3	estriction bitmap		000001		000001	
Corpro		Reporting interval (Note 9)	ms	į	5	5	
		CQI delay	ms	1	2	1	2
	•	Sub-band size	RB 6 (full s			6 (full	
CSI pro	ocess for P	DSCH scheduling			ocess 2	CSI pro	
	Cel			0	6	0	6
Q	uasi-co-loc	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
PI	MI for subf	rame 4and 9		0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000
PN	VII for subfr	ame 3 and 8		0x0000 0000	100000	0x0000 0000	100000
Maxinu		RQ transmissions		0001 0000	N/A	0001 0000	N/A
		edback mode		Multiplexing	N/A N/A	Multiplexing	N/A
Note 1:		reports in an available	unlink reporting insta				
NOLE I.		SF#(n-4), this reported					
Note 2:	3 symbols	allocated to PDCCH.					
Note 3:	Reference	e measurement channe	el RC.12 TDD accord	ling to Table A.4-1	. PDSCH transmi	ssion is scheduled	d on subframe 4
	and 9 from						
Note 4:		NG OP.8 TDD is trans					
Note 5:		NG OP.8 TDD is trans					
Note 6:		collisions between CQI					
		CI format 0 shall be tr		SF#3 and #8 to a	allow periodic CQ	/PMI to multiplex	with the HARQ-
NI / -		USCH in uplink SF#7		си I.С			
Note 7:		test, the minimum requ	urements shall be fulf	filled for at least of	ne of the two SNR	(s) and the respe	ctive wanted
Note 8:		CI format 0 with a trig		shall be transmitt	ed in downlink SF	#3 and #8 to allov	v aperiodic
N		RI to be transmitted in					
Note 9:		sub-bands which are i					
Note 10:		ng interval is set to the					
		K reports. In the case					
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							
	verification		I in subframe SF#7 o				

	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 9.3.6.2-2 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		
Bandwidth		MHz	10		
Transmis	sion mode		6		
Propagati	on channel		EVA5		
Precoding	granularity	PRB	50		
	tion and onfiguration		Low 2 x 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3		
power	$ ho_{\scriptscriptstyle B}$	dB	-3		
allocation	σ	dB	0		
N	r(j) oc	dB[mW/15kHz]	-98		
Reporti	ng mode		PUSCH 3-1		
Reportin	g interval	ms	1		
PMI dela	y (Note 2)	ms	8		
	ent channel		R. 10 FDD		
	Pattern		OP.1 FDD		
	er of HARQ hissions		4		
	ncy version sequence		{0,1,2,3}		
Note 1:	For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).				
Note 2: I					

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			
Bandwidth		MHz	10			
Transmis	sion mode		6			
	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	dB[mW/15kHz]	-98			
	ng mode		PUSCH 3-1			
	g 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				
	ransmission i					
-	instance at subrame SF#n based on PMI					
		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.

			<b>_</b>		
	imeter	Unit	Test 1		
	dwidth	MHz	10		
	sion mode		6		
	ion channel		EVA5		
	ation and onfiguration		Low 4 x 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6		
power	$ ho_{\scriptscriptstyle B}$	dB	-6		
allocation	σ	dB	3		
Ν	$V_{oc}^{(j)}$	dB[mW/15kHz]	-98		
PMI	delay	ms	8 or 9		
	ing mode		PUCCH 2-1 (Note 6)		
	periodicity	ms	$N_{\rm pd} = 2$		
Physical	channel for eporting		PUSCH (Note 3)		
PUCCH F	Report Type and CQI/PMI		2		
PUCCH F	Report Type band CQI		1		
	nent channel		R.14-1 FDD		
	Pattern		OP.1/2 FDD		
	g granularity	PRB	6 (full size)		
Number o	f bandwidth				
parts (J)			3		
	К		1		
cqi-pmi-0	ConfigIndex		1		
Max numb	er of HARQ		4		
transr	nissions		+		
	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		
			cannot be applied at the eNB		
	downlink befo				
			Q-ACK and wideband CQI/PMI or		
			eport both on PUSCH instead of		
			nall be transmitted in downlink		
			odic CQI to multiplex with the		
	HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.				
			aving 2RBs in the last bandwidth		
			stead data is to be transmitted on		
	the most recently used subband for bandwidth part with j=1.				
	Note 5: In the case where wideband PMI is reported, data is to be				
transmitted on the most recently used subband. Note 6: The bit field for PMI confirmation in DCI format 1B shall be mapped					
			indicate the codebook index used		
			[4] according to the latest PMI		
	report on PUC				
L		••			

Table 9.4.1.2.1-1 PMI test for single-layer (FDD)

Table 9.4.1.2.1-2	Minimum r	equirement (	(FDD)
	Willing the second seco	equilement (	וששיו

	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 configuration			1
Special	subframe guration		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
	Report Type		1
	band CQI		
	nent channel		R.14-1 TDD
	B Pattern		OP.1/2 TDD
	g granularity	PRB	6 (full size)
Number of bandwidth			3
parts (J)			1
K cqi-pmi-ConfigIndex			4
Max number of HARQ			т
	missions		4
Redunda	ncy version		(0, 1, 2, 2)
	sequence		{0,1,2,3}
	CK fedback lode		Multiplexing
Note 1:		recoder selection. th	ne precoder shall be updated in
		e downlink transmis	
Note 2:			plink reporting instance at
	subrame SF#	n based on PMI est	imation at a downlink SF not later
			cannot be applied at the eNB
	downlink befo		
Note 3:			Q-ACK and wideband CQI/PMI or
			port 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 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 TPMI 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 PUC	CH.	

# 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.

	meter	Unit	Test 1
	lwidth	MHz	10
	sion mode		9 EPA5
	on channel granularity	PRB	50
Correla	tion and	FND	Low
	onfiguration		ULA 4 x 2
Cell-specifi	c reference		Antenna ports
	nals		0,1
	nce signals		Antenna ports 15,,18
Beamform	ning model		Annex B.4.3
CSI-RS per	riodicity and		
	ne offset		5/ 1
T <sub>CSI-RS</sub>	/ $\Delta_{CSI-RS}$		
signal cor	reference nfiguration		6
	SubsetRestr bitmap		0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
	σ	dB	-3
N	(j) oc	dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 3-1
Reportin	g interval	ms	5
PMI dela	y (Note 2)	ms	8
	ent channel		R.44 FDD
	Pattern		OP.1 FDD
Max number of HARQ			4
transmissions			
Redundancy version coding sequence			{0,1,2,3}
		recoder selection th	ne precoder
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			
instance at subrame SF#n based on PMI			
estimation at a downlink SF not later than SF#(n-			
<ul> <li>4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 3: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per</li> </ul>			oplied at the
			ING 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.

Derer	motor	l Init	Toot 1
Parar Band		Unit MHz	<b>Test 1</b> 10
Bandwidth Transmission mode		1011 12	9
Uplink downlink			
configu			1
Special s	ubframe		4
configu			
Propagatio			EVA5
	granularity	PRB	50
Antenna co	onfiguration		8 x 2
Correlation			High, Cross polarized
Cell-specifi sigr			Antenna ports 0,1
CSI referer	nce signals		Antenna ports 15,,22
Beamform			Annex B.4.3
CSI-RS per subfram			5/ 4
CSI-RS r	eference		2
signal cor			0
CodeBookS iction b			0x0000 0000 001F FFE0 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$\rho_{\scriptscriptstyle B}$	dB	0
power	Pc	dB	-6
allocation	σ	dB	-0 -3
N		-	-
	00	dB[mW/15kHz]	-98
Reportir			PUSCH 3-1
Reporting		ms	5
PIMI dela	y (Note 2)	ms	10 R.45-1 TDD
Measurement channel			for UE Category 1, R.45 TDD for UE Category ≥2
OCNG Pattern			OP.7 TDD for UE Category 1, and OP.1 TDD for UE Category ≥2
Max number of HARQ transmissions			4
Redundan coding s			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
Note 1: F S Note 2: If ir e 4	<ul> <li>shall be updated in each TTI (1 ms granularity).</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</li> </ul>		is granularity). plink reporting on PMI ater than SF#(n-
eNB downlink before SF#(n+4). Note 3: 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 uplink SF#3 and #8.		ink SF#4 and #9	

Table 9.4.1.3.2-1 PMI test for single-layer (TDD)

Note 4:	Randomization of the principle beam direction
	shall be used as specified in B.2.3A.4

## Table 9.4.1.3.2-2 Minimum requirement (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.

Para	neter	Unit	Test 1
Bandwidth		MHz	10
Transmission mode		WII 12	6
			EPA5
Propagation channel Precoding granularity (only for reporting and following 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	(j) oc	dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
Reportin		ms	1
PMI	delay	ms	8
Measurement channel			R.11-3 FDD for UE Category 1, R.11 FDD for UE Category ≥2
OCNG Pattern			OP.1/2 FDD
Max number of HARQ transmissions			4
Redundancy version		{0,1,2,3}	
<ul> <li>Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).</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>			
F			

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.

r		1	
	neter	Unit	Test 1
	width	MHz	10
	sion mode		6
	lownlink		1
	uration		•
	subframe		4
	uration		
	on channel		EPA5
	granularity		0
	porting and	PRB	6
	ng PMI)		
	tion and		Low 2 x 2
antenna co	onfiguration		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
anocation	σ	dB	0
N	(j) oc	dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 1-2
	g interval	ms	1
PMI	delay	ms	10 or 11
			R.11-3 TDD
			for UE
Measurem	ent channel		Category 1
Measurenn			R.11 TDD for
			UE Category
-			≥2
	Pattern		OP.1/2 TDD
	er of HARQ		4
	issions		
Redundancy version			{0,1,2,3}
	equence K feedback		
	de		Multiplexing
		recoder selection, th	
shall be updated in each available downlink transmission instance.			e downlink
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			oplied at the
eNB downlink before SF#(n+4). Note 3: One/two sided dynamic OCNG Pattern OF			
		d dynamic OCNG Pa ribed in Annex A.5.2	
	IDD as desci Ised.	ibed in Annex A.5.2	. 1/2 shall de
นจธน.			

Table 9.4.2.1.2-1 PMI test for single-layer (TDD)

Table 9.4.2.1.2-2 Minimum	requirement (	(TDD)	
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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	
Transmi	ssion mode		6	
Propagat	ion channel		EVA5	
	ation and configuration		Low 4 x 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6	
power	$ ho_{\scriptscriptstyle B}$	dB	-6	
allocation	σ	dB	3	
Ι	$N_{oc}^{(j)}$ dB[mW/15kHz] -98		-98	
PM	delay	ms	8	
Reporting mode			PUSCH 2-2	
Reporti	ng interval	ms	1	
Measuren	nent channel		R.14-2 FDD	
OCNG Pattern			OP.1/2 FDD	
Subbar	nd size ( <i>k</i> )	RBs	3 (full size)	
Number of preferred 5 subbands ( <i>M</i> )		5		
	Max number of HARQ 4		4	
	Redundancy version coding sequence {0,1,2,3}			
Note 1:		om precoder selection, the precoder shall be updated in		
		ms granularity)		
Note 2:		eports in an available uplink reporting instance at		
			imation 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 9.4.2.2.1-1 PMI test for single-layer (FDD)

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		1
	uration		
	subframe uration		4
	on channel		EVA5
	tion and		Low 4 x 2
antenna c	onfiguration		L0W 4 X 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N	r(j) oc	dB[mW/15kHz]	-98
PMI	delay	ms	10
Reporti	ng mode		PUSCH 2-2
Reportin	g interval	ms	1
	ent channel		R.14-2 TDD
	Pattern		OP.1/2 TDD
	d size ( <i>k</i> )	RBs	3 (full size)
Number of preferred subbands ( <i>M</i> )			5
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback			Multiplexing
mode			. •
Note 1: For random precoder selection, the precoders shall be updated in			
	each available downlink transmission instance.		
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).			
downlink belore SF#(11+4).			

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	ססס	0
	porting and ng PMI)	PRB	6
	tion and		Low
	onfiguration		ULA 4 x 2
	ic reference		Antenna ports
	nals		0,1
	nce signals		Antenna ports 15,,18
Beamforn	ning model		Annex B.4.3
	riodicity and		7
	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
	er of HARQ		4
Redundar	ncy version sequence		{0,1,2,3}
		recoder selection. th	ne precoders
Note 2:	For random precoder selection, the precoders 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-		
Note 3: Note 4:			

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.

Parar		Unit MHz	<b>Test 1</b> 10
Band		IVIHZ	9
Transmission mode Uplink downlink			
configuration			1
Special s			4
config	uration		4
	on channel		EVA5
	granularity		
only for re	porting and	PRB	6
Antenna co			8 x 2
			High, Cross
Correlation	n modeling		polarized
	c reference		Antenna ports
sigr	nals		0,1
CSI referen	nce signals		Antenna ports 15,,22
Beamform			Annex B.4.3
CSI-RS per			
	e offset		5/ 4
	′ ∆ <sub>CSI-RS</sub>		
signal cor			4
Signal col	ingulation		0x0000 0000
CodeBookS	SubsetRestr		001F FFE0
iction I	oitmap		0000 0000
			FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	db	-6
	σ	dB	-3
N	(j) oc	dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
Reportin		ms	5 (Note 4)
PMI	delay	ms	10
Measureme	ent channel		R.45-1 TDD for UE Category 1, R.45 TDD for
			UE Category ≥2
			OP.7 TDD for
00000	D //		UE Category 1
OCNG	Pattern		OP.1 TDD for
			UE Category ≥2
Max numbe	er of HARO		
transm			4
Redundan	cy version		{0,1,2,3}
coding s			
ACK/NACK feedback mode			Multiplexing
Note 1: For random precoder selection, the precoders			
s	shall be updated in each TTI (1 ms granularity).		
instance at subrame SF#n based on PMI			
estimation at a downlink SF not later than SF#(n-			ater than SF#(n-
	4), this reported PMI cannot be applied at the		
		before SF#(n+4).	
Note 3: Void. Note 4: PDCCH DCI format 0 with a trigger 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		
		dB		0		
Propagation condit antenna configu				2 x 2 EPA5		
CodeBookSubsetRo			0000	11 for fixed RI = 1		
	estriction			00 for fixed $RI = 2$		
bitmap			010011	for UE reported	RI	
Antenna correla	ation		Low	Low	High	
RI configurati	on		Fixed RI=2 and	Fixed RI=1	Fixed RI=1	
	UII		follow RI	and follow RI	and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-98	-78	-78	
Maximum number o				1		
transmissions Reporting mode			PUCCH 1-1 (Note 4)			
Physical channel for						
reporting			PL	JCCH Format 2		
PUCCH Report T CQI/PMI	ype for		2			
Physical channel	for RI		Pl	JSCH (Note 3)		
reporting				. ,		
PUCCH Report Typ				3		
Reporting perior		ms	$N_{\rm pd}=5$			
PMI and CQI d		ms		8		
cqi-pmi-Configurati				6		
ri-Configuration				1 (Note 5)	514	
			ting instance at subfra			
			ot later than SF#(n-4), NB downlink before S		li and	
			D according to Table A		ed dynamic	
		FDD as described in			eu uynamic	
			d HARQ-ACK it is ned	researy to report	hoth on	
PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8						
and #3.						
		ding information in [	DCI format 2 shall be r	napped as:		
			recoding information b			
			recoding information b			
			recoding information b			
Note 5: To avoid t	he ambiguit	y of TE behaviour w	when applying CQI and	d PMI during rank		
			ne subframe delay in a			
	MI reports.				-	

Table 9.5.1.1-2	Minimum	requirement	(FDD)
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	Test 1	Test 2	Test 3
<i>)</i> 1	N/A	1.05	0.9
Ýź	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	۱	MHz	10			
PDSCH transmissi	ion mode		4			
	$ ho_{\scriptscriptstyle A}$	dB		-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3			
	σ	dB	0			
Uplink downlink cor	figuration			2		
Special subfra configuration	ame			4		
Propagation cond antenna configu				2 x 2 EPA5		
CodeBookSubsetR bitmap	estriction		000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI			
Antenna correl	ation		Low	Low	High	
RI configurat	ion		Fixed RI=2 and Fixed RI=1 Fixed I		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 number of HARQ transmissions				1		
Reporting mo	ode		PUS	SCH 3-1 (Note 3)		
Reporting inte		ms		5		
PMI and CQI of	delay	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 PM 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).						
Note 2: Reference OCNG Pa	e measurem attern OP.1	nent channel RC.2 T TDD as described ir	and RC.2 TDD according to Table A.4-1 with one sided dynamic described in Annex A.5.2.1.			

#### 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>y</i> 1	N/A	1.05	0.9
1/2	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		
	transmissic	n mode			9	
		$\rho_{A}$	dB		0	
Downlin	Downlink power $\rho_{\scriptscriptstyle B}$		dB		0	
alloca		PB	dB	0		
		σ	dB	0		
Propaga	ation condit		ub .		-	
	na configur				2 x 2 EPA5	
	fic reference			Ar	ntenna ports 0	
	nforming M				ified in Section B.	.4.3
CSI re	eference sig	gnals		Ante	enna ports 15, 16	
sul	S periodicit bframe offs	et			5/1	
	: <u>sı-Rs / ∆csi-F</u> reference si				6	
	onfiguratior				6	
CodeBoc	kSubsetRe	estriction			11 for fixed $RI = 1$	
COUCEDO	bitmap				00 for fixed $RI = 2$	
Aista	•	4: a.a			for UE reported Low	RI High
Ante	nna correla	llion		Low Fixed RI=2 and	Fixed RI=1	Fixed RI=1
RI	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
	n number o ansmission				1	
	porting mo				PUCCH 1-1	
	channel for			PUSCH (Note 3)		
	reporting					
	H Report Ty CQI/PMI	•			2	
Physic	al channel reporting	for RI		PU	ICCH Format 2	
PUCCH	Report Typ	e for RI			3	
	orting period		ms		$N_{\rm pd} = 5$	
	and CQI de		ms		8	
	Configurati				2	
	onfiguration				1 (Note 4)	
				porting instance at sub		
				ot later than SF#(n-4),		1I and
Note 2:	<ul> <li>wideband CQI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>e 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.</li> </ul>					sided dynamic
Note 3:	Note 3: To avoid collisions be		tween CQI/ PMI rep	orts and HARQ-ACK		
				format 0 shall be tran with the HARQ-ACK		
	#5.					
	Note 4: To avoid the ambiguit		ied at the TE with o	when applying CQI and ne subframe delay in a		

#### Table 9.5.2.1-1 RI Test (FDD)

	Test 1	Test 2	Test 3
<i>γ</i> 1	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.

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz		10	
PDSCH transmission mode				9	
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Uplink downlink conf				1	
Special subfrai				4	
configuration				Т	
Propagation condition				2 x 2 EPA5	
antenna configur				2 X 2 EI XO	
Cell-specific reference				ntenna ports 0	
CSI reference sig				nna ports 15, 16	
Beamforming M	odel		As speci	fied in Section B	.4.3
CSI reference si				4	
configuration				4	
CSI-RS periodicit	y and				
subframe offs	et			5/4	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-R}}$	RS				
CodeBookSubsetRe	striction		0000	11 for fixed RI = 1	1
	SILICION		01000	00 for fixed $RI = 2$	2
bitmap			010011	for UE reported	RI
Antenna correla	tion		Low	Low	High
RI configuration	n		Fixed RI=2 and	Fixed RI=1	Fixed RI=1
-			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	f HARQ			1	•
transmission	S				
Reporting mod				PUCCH 1-1	
Physical channel for	CQI/ PMI		PI	JSCH (Note 3)	
reporting					
PUCCH report type PMI	for CQI/			2	
Physical channel	for RI		PU	CCH Format 2	
reporting			_	N 5	
Reporting period		ms		$N_{\rm pd} = 5$	
PMI and CQI de		ms		10	
ACK/NACK feedbac			Bundling		
cqi-pmi-Configuratio				4	
ri-ConfigurationInd 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					
					ii and
			NB downlink before S		aidad dupamia
Note 2: Reference measurem				A.4-1 WITH ONE S	sueu uynamic
		FDD as described in		t in nononny to	roport both on
			orts and HARQ-ACK i format 0 shall be tran		
			with the HARQ-ACK		
	henonic C			n rusun in upi	IIIK OF#3 and
#8.					

# Table 9.5.2.2-1 RI Test (TDD)

Table 9.5.2.2-2 Minimum requirement (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.

Parameter		l lm it	Т	est 1	Tes	st 2
Parameter		Unit	Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth		MHz		10	1	
PDSCH transmissio			3	Note 10	3 Note 10	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3	-3	
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3		-3	
	σ	dB		0	0	
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		Fixed	_ow	Lc	W
RI configuratio	n		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
$N_{oc}^{(j)}$	$N_{oc2}^{(j)}$	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
$\hat{I}^{(j)}_{or}$	$\hat{I}_{or}^{(j)}$		-98	-110	-78	-92
Subframe Configu	ration		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	00000000000000000000000000000000000000
RLM/RRM Measur Subframe Pattern (			1000000 1000000 1000000 1000000 1000000	N/A	1000000 1000000 1000000 1000000 1000000	N/A
CSI Subframe Sets (Note 8)	C <sub>CSI,0</sub>	-	10000000 1000000 1000000 1000000 0111111	N/A	10000000 10000000 10000000 10000000 0111111	N/A
Number of control Symbols	Number of control OFDM Symbols		3	3	3	3
Maximum number o transmission	S			1	1	
Reporting mod Physical channel for reporting				CH 1-0 I Format 2	PUCC PUCCH	H 1-0 Format 2
PUCCH Report Type	e for CQI			4	2	1

# 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:	Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 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		<u> </u>	
Special subfra					-	
configuration			4		4	
$\rho_A$		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
CodeBookSubsetRestriction bitmap			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
$N_{\scriptscriptstyle oc}^{(j)}$	$N_{oc2}^{(j)}$	dB[mW/15k Hz]	-98 (Note 5)	N/A	-98 (Note 5)	N/A
	$N_{oc3}^{(j)}$		-98 (Note 6)	N/A	-94.8 (Note 6)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	-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 Measurement Subframe Pattern (Note 8)			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)

	channel for C <sub>CSI,1</sub> CQI nd RI reporting		PUSCH (Note 3)		PUSCH (Note 3)	
PUCCH Report Type for RI			3		3	
Rep	orting periodicity	ms	N <sub>pd</sub> =	= 10	N <sub>pd</sub> =	= 10
ACK/NA	ACK feedback mode		Multip	lexing	Multip	lexing
	-ConfigurationIndex		8		8	
-	ConfigurationInd		5		5	
	ConfigurationIndex2		g		ç	
	onfigurationInd2		C		(	
	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	s reported wideba	nd CQI cannot
Note 2:	Reference measurem dynamic OCNG Patte					with one sided
Note 3:	To avoid collisions be PUSCH instead of PL 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.	n OFDM symb	ols #0, #4, #7	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 overl	apping with aggre	essor non-ABS
Note 7:	ABS pattern as define					
	PDCCH/PCFICH are		•			
	with the ABS subfram	e of aggressor	cell and the	subframe is a	available in the de	efinition of the
	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 accordi measurements define		domain meas	surement res	ource restriction p	battern for CSI
Note 10:	Cell 1 is the serving cand Cell 2 is the same	ell. Cell 2 is the	e aggressor c	ell. The num	ber of the CRS po	orts in Cell 1
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>γ</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 configura			2×2 EPA5 (Note 2)	2×2 EPA5 (Note 2)	2x2 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]	-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	10000000 10000000 10000000 10000000 1000000	10000000 10000000 10000000 10000000 1000000
RLM/RRM Measur Subframe Pattern (I			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			4 PUCCH Format 2	N/A N/A	N/A N/A
PUCCH Report Typ			3	N/A	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-pr	ni-ConfigurationIndex		11	N/A	N/A		
ri-ConfigurationInd		5	N/A	N/A			
cqi-pmi-ConfigurationIndex2			10	N/A	N/A		
ri-C	ConfigurationInd2		2	N/A	N/A		
	Cyclic prefix		Normal	Normal	Normal		
Note 1: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying							
OCNG pattern OP.5 FDD as defined in Annex A.5.1.5.							
Note 2:							
Note 3:	This noise is applied in O		#1, #2, #3, #5, #6, #8	3, #9, #10,#12, #1	3 of a subframe		
	overlapping with the aggr						
Note 4:	This noise is applied in O	FDM symbols	#0, #4, #7, #11 of a s	subframe overlapp	ping with the		
–	aggressor ABS.						
Note 5:	This noise is applied in al						
Note 6:	ABS pattern as defined in						
	PDCCH/PCFICH are tran						
	overlapped with the ABS		ggressor cell and the	subframe is avail	able in the		
Note 7:	definition of the reference		atriation nottorn for D		to op defined in		
Note 7.	Time-domain measureme	ent resource re	striction pattern for P	Cell measuremen	its as defined in		
Note 8:	As configured according t	o the time-dor	nain measurement re	source restriction	pattern for CSI		
	measurements defined in						
Note 9:	The number of control OF		s not available for AB	S and is 3 for the	subframe		
	indicated by "0" of ABS pa						
Note 10:	If the UE reports in an available		eporting instance at s	subframe SF#n ba	sed on CQI		
	estimation at a downlink s	subframe not la	ater than SF#(n-4), th	is reported wideb	and CQI cannot		
	be applied at the eNB dow	wnlink before S	SF#(n+4).	-			
Note 11:							
	dynamic OCNG Pattern C	)P.1 FDD as d	escribed in Annex A.	5.1.1.			
Note 12:	The number of the CRS p			e same.			
Note 13:	SIB-1 will not be transmit	ted 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 transmissio	n mode		3	As defined in Note 1	As defined in Note 1
Uplink downlink confi			1	1	1
Special subframe con	figuration		4	4	4
Deverliek newer	$ 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	striction		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]	-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
	$N_{oc3}$	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
$\widehat{E}_{s}/N_{oc2}$		dB	Reference Value in Table 9.5.4.2-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	Reference Value in Table 9.5.4.2-2 for each test	-86	-88
Subframe Configu	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	Time Offset between Cells		N/A	3	-1
Frequency shift betwe	en Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	-		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
(Note 8)	C <sub>CSI,1</sub>		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number of transmissions			1	N/A	N/A
Reporting mod			PUCCH 1-0	N/A	N/A
Physical channel for C and RI reportir	C <sub>CSI,0</sub> CQI		PUCCH format 2	N/A	N/A
Physical channel for C and RI reportir	C <sub>CSI,1</sub> CQI		PUSCH (Note 14)	N/A	N/A
PUCCH Report Type			4	N/A	N/A
PUCCH Report Type			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 and Cell 3 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
Nata Or	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:	
	dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
Note 12:	
Note 13:	SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.
Note 14:	To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on
11013 14.	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)

Parameter Bandwidth		l Init	Test 1		Test 2	
		Unit	TP1	TP2	TP1	TP2
		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		dB	0	0	20	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78
$\frac{\delta r}{N_{oc}^{(j)}}$		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	el		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		0
Cell-specific referen	nce signals		Antenna Antenna ports	a ports 0	Antenna ports 0	
CSI-RS signal 0			15,16	N/A	Antenna ports 15,16	N/A
CSI-RS 0 periodicit $T_{CSI-RS} / \Delta_{CSI-RS}$	y and subframe offset		5/1	N/A	5/1	N/A
CSI-RS 0 configura	ition		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> / Δ <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	tion		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	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
Physical channel fo	or CQI/PMI reporting		PUSCH (Note 6)	N/A	PUSCH (Note 6)	PUSCH (Note 6)
PUCCH Report Typ	be for CQI/PMI		2	N/A	2	2
Physical channel fo	or RI reporting		PUCCH Format 2	N/A	PUCCH Format 2	PUCCH Format 2
PUCCH Report Typ			3	N/A	3	3
	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A
	CSI-IM Departing mode		CSI-IM 0	N/A	CSI-IM 0	N/A
	Reporting mode Reporting		PUCCH 1-1	N/A	PUCCH 1-1	N/A
CSI process 0 (Note 7)	periodicity	ms	$N_{\rm pd} = 5$	N/A	N <sub>pd</sub> = 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 Reporting		N/A	N/A	N/A	PUCCH 1-1
	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 process 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 s	ubframe 1 and 6		100000	100000	100000	N/A
Max num	ber 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>Y</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)

<b>D</b>			Te	st 1	Te	st 2
Para	ameter	Unit	TP1	TP2	TP1	TP2
Bandwidth		MHz		MHz		MHz
Transmission mode	e		10	10	10	10
$ ho_{\scriptscriptstyle A}$		dB	(	D	0	
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 1 configuration <i>I</i> <sub>CSI-RS</sub> / <i>ZeroPowerCSI-RS</i> bitmap			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 (Note 6, 7, 8)	CSI-IM		N/A	N/A	N/A	CSI-IM 1
	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 PDSCH scheduling		ms		Dicess 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 subframe 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.		
	•					
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 trigger for aperiodic CQI shall be transmitted 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 $\rho_A$		dB	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0
Propagation condit antenna configur			AWG	N (1 x 2)
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel f reporting	or CQI		PUCCH Format 2	
PUCCH Report	Туре		4	
Reporting period	dicity	ms	$N_{\rm pd} = 10$	
cqi-pmi-ConfigurationIndex			16 [shift of 5 ms relativ to Pcell]	
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 FDD as described in Annex A.5.1.1.				

#### 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		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		Unit	Pcell	Scell	
PDSCH transmission mode				1	
Uplink downlink cont	figuration		2		
Special subfra configuration			4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condition and antenna configuration			AWGN (1 x 2)		
SNR		dB	10	4	
$\hat{I}^{(j)}_{or}$		dB[mW/15kHz]	-88	-94	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	
Physical channel f reporting	or CQI		PUCCH Format 2		
PUCCH Report	Туре		4		
Reporting periodicity		ms	^	V <sub>pd</sub> = 10	
cqi-pmi-ConfigurationIndex			8 13 [shift of 5 ms relati to Pcell]		
			DSCH for user data is so as described in Annex A	cheduled for the UE with one .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		Bandwidth combination		
1	20MHz for both cells			
Note 1:	The applicability of requirements for different CA configurations 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.				

#### Table 10.1-1: Common Test Parameters (FDD)

## 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	Referen	ce 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 Iow	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).

Par	Parameter		Value
	er of HARQ cesses	Processes	None
Subcari	Subcarrier spacing		15 kHz
Allocated subframes per Radio Frame (Note 1)			5 subframes
Number of OFDM symbols for 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 antenna	BLER (%)	SNR(dB)	UE 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	172 100	1	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

FDD	Table A.2.2.2.1-1		20	QPSK	1/5	81		≥ 1	
			-	QPSK		90		≥ 1	
FDD	Table A.2.2.2.1-1		20		1/6				
FDD Par	Table A.2.2.2.1-1	16-0AM	20	QPSK	1/6	96		≥ 1	
FDD, Fai	Table A.2.2.2.2-1		1.4 - 20	16QAM	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 16QAM		3			
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM 16QAM	3/4	4		≥ 1	
					3/4			≥ 1	
FDD FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1		1.4 - 20 3 - 20	16QAM 16QAM	3/4 3/4	5 6		≥1 ≥1	
FDD			3 - 20			8		≥ 1	
FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1		3 - 20	16QAM 16QAM	3/4 3/4	9		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	-		≥ 1	
FDD	Table A.2.2.2.2-1			16QAM 16QAM		10			
FDD	Table A.2.2.2.2-1		3 - 20 5 - 20		3/4 1/2	12 15		≥1 ≥1	
				16QAM					
FDD	Table A.2.2.2.1		5 - 20 5 - 20	16QAM	1/2	16		≥1 ≥1	
FDD	Table A.2.2.2.1			16QAM	1/2	18			
FDD FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1		5 - 20 5 - 20	16QAM 16QAM	1/3 1/3	20 24		≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20		1/3	24		≥1 ≥1	
FDD				16QAM					
	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 FDD	Table A.2.2.2.2-1		15 - 20	16QAM 16QAM	3/4	54		≥ 2	
	Table A.2.2.2.1		15 - 20 15 - 20		2/3	60		≥2	
FDD FDD	Table A.2.2.2.2-1			16QAM	2/3	64		≥ 2	
	Table A.2.2.2.2-1 Table A.2.2.2.2-1		15 - 20	16QAM	1/2	72		≥ 2	
FDD			20	16QAM	1/2	75		≥2	
FDD FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1		20 20	16QAM 16QAM	1/2	80 81		≥2	
FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1			16QAM	1/2 2/5			≥ 2 ≥ 2	
FDD	Table A.2.2.2.2-1 Table A.2.2.2.2-1		20 20	16QAM	2/5 2/5	90 96		≥ 2 ≥ 2	
	I RB allocation, QP	SK	20		2/3	90		<u> </u>	
TDD, Ful	Table A.2.3.1.1-1		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.2.3.1.1-1		3	QPSK	1/3	15		≥ 1 ≥ 1	
TDD	Table A.2.3.1.1-1		5	QPSK	1/3	25		≥ 1	
TDD	Table A.2.3.1.1-1		10	QPSK	1/3	23 50		≥ 1	
TDD	Table A.2.3.1.1-1		15	QPSK	1/5	75		≥ 1	
TDD	Table A.2.3.1.1-1		20	QPSK	1/6	100		≥ 1	
	I RB allocation, 16-	QAM			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			- 1	
TDD, TDD	Table A.2.3.1.2-1		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	1/3	25		≥ 1	
100			5		1/0	20			<u> </u>

TDD	Table A.2.3.1.2-1		10	16QAM	3/4	50	≥ 2	
			-					
TDD	Table A.2.3.1.2-1		15	16QAM	1/2	75	≥2	
TDD Dou	Table A.2.3.1.2-1		20	16QAM	1/3	100	≥ 2	
-	tial RB allocation, (		4 00	ODCK	4/2	4		
TDD	Table A.2.3.2.1-1		.4 - 20	QPSK	1/3	1	≥ 1	
TDD	Table A.2.3.2.1-1		.4 - 20	QPSK	1/3	2	≥ 1	
TDD	Table A.2.3.2.1-1		.4 - 20	QPSK	1/3	3	≥1	
TDD	Table A.2.3.2.1-1		.4 - 20	QPSK	1/3	4	≥1	
TDD	Table A.2.3.2.1-1		.4 - 20	QPSK	1/3	5	≥1	
TDD	Table A.2.3.2.1-1		3 - 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	9	≥ 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	12	≥1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	15	≥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		5 - 20	QPSK	1/3	24	≥1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	25	≥1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	27	≥1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	30	≥1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	32	≥1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	36	≥ 1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	40	 ≥ 1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	45	≥ 1	
TDD	Table A.2.3.2.1-1		0 - 20	QPSK	1/3	48	≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	50	 ≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	54	 ≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/4	60	 ≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/4	64	 ≥ 1	
TDD	Table A.2.3.2.1-1	1	5 - 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	1/6	90	≥1	
TDD Bo	Table A.2.3.2.1-1		20	QPSK	1/6	96	≥ 1	
	tial RB allocation, 1		4 00	400414	0/4			
TDD	Table A.2.3.2.2-1		.4 - 20	16QAM	3/4	1	≥ 1	
TDD	Table A.2.3.2.2-1		.4 - 20	16QAM	3/4	2	≥1	
TDD	Table A.2.3.2.2-1		.4 - 20	16QAM	3/4	3	≥ 1	
TDD	Table A.2.3.2.2-1		.4 - 20	16QAM	3/4	4	≥1	
TDD	Table A.2.3.2.2-1		.4 - 20	16QAM	3/4	5	≥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	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	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 Categor 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	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		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										
Note 1: If more than one Code Block is	present, a	n addition	al CRC s	equence	of L = 24	Bits is a	ttached			
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

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 36.2	11[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,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1\\ C, & \text{if } C > 1 \end{cases}$$
 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	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	-	-	
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)	1			
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	annel e	dge)
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, FDD	Table A.3.3.2.1-3	R.60 FDD	10	64QAM		50		≥ 3	
	CH Performance, N				i). Two		na nort	-	
FDD, FDG	Table A.3.3.2.1-1	R.10 FDD	10	QPSK	1/3	50		<b>3</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.11-1 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-2 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-3 FDD	10	16QAM	1/2	40		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-4 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.30 FDD	20	16QAM	1/2	100		≥ 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	20	64QAM	0.39	100		4	
עטי	Table A.J.J.Z. 1-1	11.00-11-00	20		0.09	100		7	

FDD	Table A.3.3.2.1-1	R.35-2 FDD	15	64QAM	0.39	75		≥ 2	<u>Г</u>
			-						
FDD	Table A.3.3.2.1-1	R.35-3 FDD	10	64QAM	0.39	50		≥2	
FDD	Table A.3.3.2.1-2	R.35-4 FDD	10	64QAM	0.47	50		≥2	
FDD	Table A.3.3.2.1-2	R.46 FDD	10	QPSK		50		≥1	
FDD	Table A.3.3.2.1-2	R.47 FDD	10	16QAM		50		≥ 1	
	CH Performance, N	[		-	1	1	na por	1	
FDD	Table A.3.3.2.2-1	R.12 FDD	1.4	QPSK	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			-	-	1	1	-	
FDD	Table A.3.3.3.1-1	R.51 FDD	10	16QAM	1/2	50		≥2	
	CH Performance (U				1	1	on Qua	1	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	- ·	) Four a	-	rts (CS	I-RS)	1	1	
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	
TDD, PDS	CH Performance, S	ingle-antenna	transmi	ission (CR	S)	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	annel 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 (MB	SFN C	onfiguration)
TDD	Table A.3.4.1-5	R.29 TDD	10	16QAM	1/2	1		≥ 1	
I	-	1		1	I	1	I	I	l

TDD, PDS	CH Performance: C	arrier aggrega	ation wit	th power in	mbalan	се			
TDD	Table A.3.4.1-7	R.49 TDD	20	64QAM	0.81- 087	100		≥ 5	
TDD. PDS	CH Performance, N	lulti-antenna t	ransmis	sion (CRS		antenr	na port	s	
TDD	Table A.3.4.2.1-1	R.10 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.2.1-1	R.11 TDD	10	16QAM	1/2	50		≥ 2	
TDD	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		50		≥ 1	
TDD	Table A.3.4.2.1-2	R.47 TDD	10	16QAM		50		≥ 1	
TDD, PDS	CH Performance, N	lulti-antenna t	ransmis	sion (CRS	6), Four	anten	na por	ts	
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	
TDD, PDS	CH Performance, S	ingle antenna	port (DI	RS)					
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	
TDD, PDS	CH Performance, T	wo antenna po	orts (DR	S)	1	1			
TDD	Table A.3.4.3.2-1	R.31 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.2-1	R.32 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.32-1 TDD	5	16QAM	1/2	[25]		≥ 1	
TDD	Table A.3.4.3.2-1	R.33 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.3.2-1	R.33-1 TDD	10	64QAM	3/4	[18]		≥ 1	
TDD	Table A.3.4.3.2-1	R.34 TDD	10	64QAM	1/2	50		≥ 2	
	CH Performance (U			-	r •				
TDD	Table A.3.4.3.3-1	R.51 TDD	10	16QAM	1/2	50		≥ 2	
	CH Performance (U			-	-	1	on Qua		iocated)
TDD	Table A.3.4.3.3-2	R.52 TDD	10	64QAM	1/2	50		≥2	
TDD	Table A.3.4.3.3-2	R.53 TDD	10	64QAM	1/2	50		≥2	
TDD	Table A.3.4.3.3-2	R.54 TDD	10	16QAM	1/2	50		≥ 2	
TDD, PDS	Table A.3.4.3.4-1	R.44 TDD	10 <b>1</b> 0	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.4-1	R.44 TDD R.48 TDD	10	QPSK	1/2	50		≥ 2 ≥ 1	
	1000 7.0.4.0.4-1	1.40100	10			50		- 1	

TDD, PDS	CH Performance (U	E specific RS	) Eight a	antenna po	orts (CS	i-RS)		
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	
FDD, PDC	CH / PCFICH Perfo	rmance						
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				
	), PHICH Performan	nce	-					
FDD / TDD	Table A.3.6-1	R.18	10	PHICH				
FDD / TDD	Table A.3.6-1	R.19	10	PHICH				
FDD / TDD	Table A.3.6-1	R.20	5	PHICH				
FDD / TDD	Table A.3.6-1	R.24	10	PHICH				
	), PBCH Performan	се						
FDD /	Table A.3.7-1	R.21	1.4	QPSK	40/			
TDD FDD / TDD	Table A.3.7-1	R.22	1.4	QPSK	1920 40/ 1920			
FDD / TDD	Table A.3.7-1	R.23	1.4	QPSK	40/ 1920			
	H Performance				1020			
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	
FDD, Sust	ained data rate (CR	(S)						
FDD	Table A.3.9.1-1	R.31-1 FDD	10	64QAM	0.40		≥ 1	
FDD	Table A.3.9.1-1	R.31-2 FDD	10	64QAM	0.59- 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-		≥ 4	

					0.88			
FDD			15	64QAM	0.85-		~ 2	
	Table A.3.9.1-1	R.31-5 FDD	15	64QAIVI	0.91		≥ 3	
TDD, Sus	tained data rate (CF Table A.3.9.2-1	R.31-1 TDD	10	64QAM	0.40		> 1	
			-		0.40		≥ 1	
TDD	Table A.3.9.2-1	R.31-2 TDD	10	64QAM	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	5)			
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	·				. <u> </u>		
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				
L	1	L			·			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 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]										
Note 3: If more than one Code Block is pr	esent, an addi						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	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 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].								

#### 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 for	20 MHz, 15 M	/Hz and 10	) MHz char	nnel BW. 3	symbols a	llocated to	PDCCH
for 5 MHz and 3 MHz. 4 symbols a							
Note 2: Reference signal, Synchronization	i 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 $I = 24 F$	Rits 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
Note 1: 2 symbols allocated to PDCCH fo for 5 MHz and 3 MHz. 4 symbols a Note 2: Reference signal Synchronization	allocated to PI	DCCH for 1	.4 MHz.		•	llocated to	PDCCH

#### 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 syn								
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.				<b>TO 00 04</b>	4 5 4 3			
Note 3: Reference signal, Synchronization							h Cada	
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). Note 5: As per Table 4.2-2 in TS 36.211 [4	11							
Note 5: As per Table 4.2-2 in TS 36.211 [4	tj.							

#### 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	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 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 special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.									
<ul> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per 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> <li>Note 5: As per Table 4.2-2 in TS 36.211 [4].</li> </ul>									

#### 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			
lumber 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.				<b>TO 00 04</b>	4 5 4 3					
Note 3: Reference signal, Synchronization										
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	tj.									

#### 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			Valu	Je		
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	s 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			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
						≥ 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							

Table A.3.3.1-3a: Fixed Reference Channel 64C	≀AM R=3/4
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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:

Table A.3.3.1-4: Fixed Reference Channel Single PRB (	Channel Edge)
Table Aloidin 4. Tixed Reference Onumer Omgle TRD (	

Parameter	Unit	Value					
Reference channel			R.0 FDD		R.1 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 for PDCCH for 5 MHz and 3 MHz; 4         Note 2:       Reference signal, synchronizatio         Note 3:       If more than one Code Block is p         Code Block (otherwise L = 0 Bit).	symbols allocan signals and for a signals and for a signal	ated to PI PBCH allo	DCCH for 1. ocated as pe	4 MHz. er TS 36.2	211 [4].		

	Parameter	Unit	Value			
Reference channel			R.29 FDD			
			(MBSFN)			
Channel	Channel bandwidth		10			
Allocated	Allocated resource blocks		1			
MBSFN (	MBSFN Configuration (Note 3)		111111			
Allocated	subframes per Radio Frame		3			
Modulatio	n		16QAM			
Target Co	oding Rate		1/2			
Informatio	on Bit Payload					
For Sub	-Frames 4,9	Bits	256			
For Sub	-Frame 5	Bits	N/A			
For Sub	For Sub-Frame 0		256			
For Sub	-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)			
Number of	Number of Code Blocks per Sub-Frame					
(Note 4)						
For Sub-Frames 4,9			1			
For Sub-Frame 5			N/A			
For Sub	-Frame 0		1			
For Sub	For Sub-Frame 1,2,3,6,7,8		0 (MBSFN)			
Binary Channel 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: MBSFN Subframe Allocation as defined in [7], one frame						
	with 6 bits is chosen for MBSFN subframe allocation.					
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.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit		Value									
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 1: 2 symbols allocated to PDCCH for to PDCCH for 5 MHz and 3 MHz; Note 2: Reference signal, synchronization	4 symbols all	ocated to	PDCCH	for 1.4 N	IHz.	bols allo	cated					
Note 3: If more than one Code Block is p	resent, an add											

Table A.3.3.1-6: Fixed Reference Channel QPSK R=1/10	0
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### Table A.3.3.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit	Value				
Reference channel		R.49 FDD				
Channel bandwidth	MHz	20				
Allocated resource blocks		100				
Allocated subframes per Radio Frame		9				
Modulation		64QAM				
Coding Rate						
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 Bit Payload						
For Sub-Frames 0,1,2,3,4,6,7,8,9	Bits	63776				
For Sub-Frame 5	Bits	N/A				
Number of Code Blocks per Sub-Frame (Note 3)						
For Sub-Frames 0,1,2,3,4,6,7,8,9	Code Blocks	11				
For Sub-Frame 5	Code Blocks	N/A				
Binary Channel 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. Throughput averaged over 1 frame	Mbps	57.398				
UE Category		≥5				
<ul> <li>Note 1: 3 symbols allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>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).</li> </ul>						

# A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

## A.3.3.2.1 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	MHz	10	10	10	5	10	10	20	15	20	10	15	10
bandwidth													
Allocated		50	50	50	25	40	50	100	75	100	50	75	50
resource blocks (Note 4)													
Allocated		9	9	8	9	9	9	9	8	8	9	8	8
subframes per													
Radio Frame		0001/	400414	400414	4004	4004	000	4004	4004	0404	040414	0.40.4	0404
Modulation		QPSK	16QAM	16QAM	16QA M	16QA M	QPS K	16QA M	16QA M	64QA M	64QAM	64QA M	64QA M
Target Coding		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39	1/2	0.39	0.39
Rate													
Information Bit													
Payload (Note 4)													
For Sub-	Bits	4392	12960	12960	5736	1029	6968	2545	1908	3057	19848	2292	15264
Frames						6		6	0	6		0	
1,2,3,4,6,7,8,9													
For Sub-	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
Frame 5 For Sub-	Dito	4202	12060	N/A	4069	1020	6069	2545	N/A	N/A	10000	N1/A	N/A
For Sub- Frame 0	Bits	4392	12960	IN/A	4968	1029 6	6968	2545 6	N/A	N/A	18336	N/A	IN/A
Number of													
Code Blocks													
(Notes 3 and 4)	D'/												
For Sub- Frames	Bits	1	3	3	1	2	2	5	4	5	4	4	3
1,2,3,4,6,7,8,9													
For Sub-	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
Frame 5													
For Sub-	Bits	1	3	N/A	1	2	2	5	N/A	N/A	3	N/A	N/A
Frame 0													
Binary Channel Bits (Note 4)													
For Sub-	Bits	13200	26400	26400	1200	2112	1320	5280	3960	7920	39600	5940	39600
Frames					0	0	0	0	0	0		0	
1,2,3,4,6,7,8,9													
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-	Bits	12384	24768	N/A	1036	1948	1238	5116	N/A	N/A	37152	N/A	N/A
Frame 0					8	8	4	8					
Max.	Mbps	3.953	11.664	10.368	5.086	9.266	6.271	22.91	15.26	24.46	17.712	18.33	12.211
Throughput								0	4	1		6	
averaged over 1 frame (Note													
4)													
UE Category	İ	≥ 1	≥2	≥2	≥ 1	≥ 1	≥ 1	≥2	≥2	4	≥2	≥ 2	≥2
Note 1: 2 symb						nd 10 MH	z channe	el BW; 3 :	symbols a	allocated	to PDCCH	l for 5 M⊦	Iz and 3
				H for 1.4 N									
				signals and						obod t-	oob Ocale	Diack (	
Note 3: If more $L = 0 E$		e Code B	lock is pre	sent, an ac	aditional (	SKC seq	uence of	L = 24 B	its is atta	unea to e	ach Code	DIUCK (Ot	IEIWISE
		oonent ca	rrier per co	deword.									
				DD45 are	- 11	-1							

Note 5: For R.11-3 resource blocks of RB6–RB45 are allocated.

Parameter	Unit				Va	lue			
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 PDCCH				IHz channe	I BW; 3	symbols	allocated	to PDCCH	for 5 MHz
and 3 MHz; 4 symbols allocate									
Note 2: Reference signal, synchroniza									
Note 3: If more than one Code Block i	s present,	an additio	nal CRC se	quence of	L = 24 E	Bits is att	ached to e	each Code	Block
(otherwise L = 0 Bit)									
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 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, 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									
Reference	e channel	•	R.51 FDD							
	bandwidth	MHz	10							
	I resource blocks	111112	50 (Note 3)							
	I subframes per Radio Frame		9							
Modulatio	•		16QAM							
	oding Rate		1/2							
	on Bit Payload		.,_							
	p-Frames 1,4,6,9	Bits	11448							
	p-Frames 2,3,7,8	Bits	11448							
	-Frame 5	Bits	N/A							
For Sub	p-Frame 0	Bits	9528							
	of Code Blocks (Note 4)									
	-Frames 1,4,6,9	Code	2							
		blocks								
For Sub	o-Frames 2,3,7,8	Code	2							
		blocks								
For Sub	-Frame 5	Bits	N/A							
For Sub	o-Frame 0	Bits	2							
Binary Cl	hannel Bits									
For Sub	o-Frames 1,4,6,9	Bits	24000							
For Sub	-Frames 2,7		23600							
For Sub	o-Frames 3,8		23200							
For Sub	-Frame 5	Bits	N/A							
For Sub	o-Frame 0	Bits	19680							
Max. Thr	oughput averaged over 1	Mbps	10.1112							
frame										
UE Cate			≥2							
Note 1:	2 symbols allocated to PDCC									
Note 2:	Reference signal, synchroniza		s and PBCH							
	allocated as per TS 36.211 [4									
Note 3:	50 resource blocks are alloca									
	4, 6, 7, 8, 9 and 41 resource k									
Note 4:	RB30–RB49) are allocated in If more than one Code Block									
11018 4.	CRC sequence of $L = 24$ Bits									
		is allacited	to each oud							
	Dioon (Otherwise L = 0 Dit).	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 2			
For Sub-Frame 0	Bits	3	3 3				
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 PDCCH							
Note 2: Reference signal, synchroniza							
Note 3: 50 resource blocks are allocat			7, 8, 9 and 41 resourc	ce blocks (RB0–			
<ul> <li>RB20 and RB30–RB49) are allocated in sub-frame 0.</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>							

# 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 PDCCI									
Note 2: Reference signal, synchroniza [4].	tion signal	s and PBCH a	Illocated as pe	r TS 36.211					
Note 3: 50 resource blocks are allocat	ed in sub-f	rames 1, 2, 3,	4, 6, 7, 8, 9 ar	nd					
	41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.								
Note 4: If more than one Code Block i									
Bits is attached to each Code									

# 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	o-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			R.4	R.42		R.2		
			TDD	TDD		TDD		
Channel b	bandwidth	MHz	1.4	20		10		
Allocated	resource blocks (Note 6)		6	100		50		
Uplink-Do	wnlink Configuration (Note 4)		1	1		1		
Allocated	subframes per Radio Frame (D+S)		3	3+2		3+2		
Modulatio			QPSK	QPSK		QPSK		
Target Co	ding Rate		1/3	1/3		1/3		
	n 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 o	f 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	annel Bits (Note 6)							
For Sub-	Frames 4,9	Bits	1368	27600		13800		
For Sub-	Frames 1,6	Bits	N/A	22656		11256		
For Sub-	Frame 5	Bits	N/A	N/A		N/A		
For Sub-		Bits	672	26904		13104		
Max. Thro	oughput averaged over 1 frame	Mbps	0.102	4.175		1.966		
(Note 6)								
UE Categ			≥ 1	≥1		≥ 1		
Note 1:	2 symbols allocated to PDCCH for 2							
	symbols allocated to PDCCH for 5 M							
	PDCCH for 1.4 MHz. For subframe	1&6, only 2	OFDM sy	mbols are	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].Note 5:If more than one Code Block is present, an additional CRC sequence of L = 24								
NOLE 5.	Bits is attached to each Code Block	(otherwise		C sequenc		= 24		
Note 6:	Given per component carrier per co		_ = 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 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 s		d PBCH a	llocated as	s 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			Val	ue		
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							

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

Block (otherwise L = 0 Bit).

Parameter	Unit			Va	lue		
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 ≥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: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [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	Value					
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 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 s		PBCH allo	cated as pe	r I'S 36.2	11 [4]		
Note 3: As per Table 4.2-2 in TS 36.211 [4]. Note 4: If more than one Code Block is pres				<i>.</i>			

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.29 TDD
			(MBSFN)
Channel b	andwidth	MHz	10
Allocated	resource blocks		1
MBSFN C	onfiguration (Note 3)		010010
Uplink-Dov	wnlink Configuration (Note 4)		1
Allocated	subframes per Radio Frame (D+S)		1+2
Modulation	1		16QAM
Target Co	ding Rate		1/2
Informatio	n Bit Payload		
For Sub-	Frames 4,9	Bits	0 (MBSFN)
For Sub-	Frames 1,6	Bits	208
For Sub-	Frame 5	Bits	N/A
For Sub-	Frame 0	Bits	256
Number of	Code Blocks per Sub-Frame		
(Note 5)			
For Sub-	Frames 4,9	Bits	0 (MBSFN)
For Sub-	Frames 1,6	Bits	1
For Sub-	Frame 5	Bits	N/A
For Sub-	Frame 0	Bits	1
Binary Cha	annel Bits Per Sub-Frame		
For Sub-	Frames 4,9	Bits	0 (MBSFN)
For Sub-	Frames 1,6	Bits	456
For Sub-		Bits	N/A
For Sub-	Frame 0	Bits	552
Max. Thro	ughput averaged over 1 frame	kbps	67.2
UE Catego			≥ 1
Note 1:	2 symbols allocated to PDCCH.		
Note 2:	Reference signal, synchronization s	ignals and	PBCH allocated as
	per TS 36.211 [4].		
Note 3:	MBSFN Subframe Allocation as def		one frame with 6
	bits is chosen for MBSFN subframe		
Note 4:	as per Table 4.2-2 in TS 36.211 [4].		
Note 5:	If more than one Code Block is pres		
	sequence of $L = 24$ Bits is attached	to each Co	ae Block (otherwise
	L = 0 Bit).		

### Table A.3.4.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit			Va	alue			
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	20 MHz, 15 I	MHz and	10 MHz (	channel I	3W; 3 sym	bols allo	cated	
to PDCCH for 5 MHz and 3 MHz; 4			PDCCH	for 1.4 M	Hz. For su	Ibframe	1&6,	
	only 2 OFDM symbols are allocated to PDCCH.							
	For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling)							
to avoid problems with insufficient F					_			
	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 pre-		tional CR	C seque	nce of L	= 24 Bits is	s attache	ed to	
each Code Block (otherwise L = 0 E	Bit).		each Code Block (otherwise $L = 0$ 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].						
Note 2: If more than one Code Block is p						
CRC sequence of $L = 24$ Bits is a	attached to e	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			Uı	nit					Va	lue
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.

Parameter	Unit	Value						
Reference channel	•	R.46 TDD	R.47 TDD	R.35-2				
				TDD				
Channel bandwidth	MHz	10	10	10				
Allocated resource		50	50	50				
blocks (Note 5)								
Uplink-Downlink		1	1	1				
Configuration (Note								
3)								
Allocated subframes		3+2	3+2	2+2				
per Radio Frame								
(D+S)								
Modulation		QPSK	16QAM	64QAM				
Target Coding Rate				0.47				
Information Bit								
Payload (Note 5)		5400	0700	40000				
For Sub-Frames 4,9	Bits	5160	8760	18336				
For Sub-Frames 1,6		3880	7480	14688				
For Sub-Frame 5	Bits	N/A	N/A	N/A				
For Sub-Frame 0	Bits	5160	8760	N/A				
Number of Code								
Blocks								
(Notes 4 and 5) 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 0		1	2	N/A				
Binary Channel Bits			۷					
(Note 5)								
For Sub-Frames 4,9	Bits	13200	26400	39600				
For Sub-Frames 1,6		10656	21312	31968				
For Sub-Frame 5	Bits	N/A	N/A	N/A				
For Sub-Frame 0	Bits	12528	25056	N/A				
Max. Throughput	Mbps	2.324	4.124	6.604				
averaged over 1								
frame (Note 5)								
UE Category		≥ 1	≥ 1	≥ 2				
			0 MHz, 15 MH					
			ymbols alloca	ted to PDCC	CH for 1.4 N	1Hz. For subf	rame 1&6,	
		are allocated						
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).								
		rwise L = 0 Bi arrier per cod						
Note 5: Given per co	mponent c	amer per coo	ewolu					

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 4)		1	1	1	1	1	1	1	
Allocated subframes per Radio		3	3+2	2+2	2	2	2+2	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	N/A	
Number of Code Blocks									
(Notes 5 and 6)									
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.									
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 Bloc (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.

Parameter	Unit			Val	ue		
Reference channel		R.25	R.26	R.26-1	R.27	R.27-1	R.28
		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>	1
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	16QAM
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2
Information Bit Payload							
For Sub-Frames 4,9	Bits	4392	12960	5736	28336	10296	224
For Sub-Frames 1,6	Bits	3240	9528	4584	22920	8248	176
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	224
Number of Code Blocks per Sub-Frame (Note 5)							
For Sub-Frames 4,9		1	3	1	5	2	1
For Sub-Frames 1,6		1	2	1	4	2	1
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	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits	12600	25200	11400	37800	13608	504
For Sub-Frames 1,6	Bits	10356	20712	10212	31068	11340	420
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	10332	20664	7752	30996	13608	504
Max. Throughput averaged over 1 frame	Mbps	1.825	5.450	2.452	12.466	4.738	0.102
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 1
<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: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource blocks (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 0.</li> </ul>							
Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each							

### Table A.3.4.3.1-1: Fixed Reference Channel for DRS

Code Block (otherwise L = 0 Bit). Note 6: Localized allocation started from RB #0 is applied.

### A.3.4.3.2 Two antenna ports (Cell Specific)

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	64QAM	
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 signNote 3:as per Table 4	.2-2 in TS 3	36.211 [4].	-		-			
Note 4: For R.31, R.32								
resource block								
DwPTS portior								
frames 4,9 and				and RB16-	-RB24) are	allocated ir	n sub-frame	
0 and the DwP					_			
Note 5: If more than or					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
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## 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				
Reference	e channel		R.51 TDD				
Channel	bandwidth	MHz	10				
Allocated	resource blocks		50 (Note 5)				
Uplink-D	ownlink Configuration (Note 3)		1				
	subframes per Radio Frame		3+2				
(D+S)	·						
Modulati	on		16QAM				
Target C	oding Rate		1/2				
	on Bit Payload						
For Sub	o-Frames 4,9 (non CSI-RS	Bits	11448				
subframe							
For Sub	-Frame 4,9	Bits	11448				
	p-Frames 1,6	Bits	7736				
	p-Frame 5	Bits	N/A				
	o-Frame 0	Bits	9528				
	of Code Blocks						
(Note 4)							
	-Frames 4, 9 (non CSI-RS	Code	2				
subframe		blocks					
For Sub	-Frames 4,9	Code	2				
	·	blocks					
For Sub	o-Frames 1,6	Code	2				
	·	blocks					
For Sub	o-Frame 5		N/A				
	o-Frame 0	Code	2				
		blocks					
Binary C	hannel Bits						
	o-Frames 4, 9 (non CSI-RS	Bits	24000				
subframe	e)						
For Sub	-Frames 4,9		22800				
	p-Frames 1,6		15744				
For Sub	o-Frame 5	Bits	N/A				
For Sub	o-Frame 0	Bits	19680				
Max. Thr	oughput averaged over 1	Mbps	4.7896				
frame							
UE Cate	gory		≥ 2				
Note 1:	2 symbols allocated to PDCCI	H.					
Note 2:	Reference signal, synchroniza	ation signal	s and PBCH				
	allocated as per TS 36.211 [4]	].					
Note 3:	as per Table 4.2-2 in TS 36.2						
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).						
Note 5:	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 t	he DwPTS	portion of				
	sub-frames 1,6.						

# 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		3+2	3+2	3+2					
(D+S)									
Modulation		64QAM	64QAM	16QAM					
Target Coding Rate		1/2	1/2	1/2					
Information Bit Payload									
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	3	3	2					
	blocks								
For Sub-Frames 1,6	Code	2	2	2					
	blocks								
For Sub-Frame 5		n/a	n/a	n/a					
For Sub-Frame 0	Code	3	3	2					
	blocks								
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	Mbps	7.1184	7.1184	4.7896					
frame									
UE Category		≥ 2	≥ 2	≥ 2					
Note 1: 2 symbols allocated to PDCCI									
Note 2: Reference signal, synchroniza	ation signal	s and PBCH allo	cated as per TS	36.211 [4].					
Note 3: as per Table 4.2-2 in TS 36.21									
attached to each Code Block									
Note 5: 50 resource blocks are allocat									
and RB30–RB49) are allocate	d in sub-fr	ame 0 and the D	wPTS portion of	sub-frames 1,					
6.									

# 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								
Reference		•	R.44 TDD	R.48					
Reference	channel			TDD					
Channel b	andwidth	MHz	10	10					
	resource blocks		50 (Note 4)	50 (Note					
Allocated I	esource blocks		50 (Note 4)						
Linkels Dev			4	4)					
	wnlink Configuration		1	1					
(Note 3)			0.0	0.0					
	subframes per Radio		3+2	3+2					
Frame (D+			040414	0001/					
Modulation			64QAM	QPSK					
Target Co			1/2						
	n Bit Payload								
	Frames 4,9 (non CSI-RS	Bits	18336	N/A					
subframe)									
	Frames 4,9 (CSI-RS	Bits	16416	6200					
subframe)									
	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-F	rames 4,9 (CSI-RS		3	2					
subframe)									
For Sub-	Frames 1,6		2	1					
For Sub-			N/A	N/A					
For Sub-	Frame 0		3	1					
	annel Bits Per Sub-								
Frame									
	Frames 4,9 (non CSI-RS	Bits	36000	12000					
subframe)									
For Sub-F	rames 4,9 (CSI-RS	Bits	33600	11600					
subframe)									
	Frames 1,6		23616	7872					
For Sub-		Bits	N/A	N/A					
For Sub-		Bits	29520	9840					
	ughput averaged over 1	Mbps	7.1184	2.5896					
frame	agiipat atolagoa otol 1	mopo		2.0000					
UE Catego	rv		≥ 2	≥ 1					
Note 1:	2 symbols allocated to PD	ICCH							
Note 2:	Reference signal, synchro		nals and PBC	H					
allocated as per TS 36.211 [4].									
Note 3: as per Table 4.2-2 in TS 36.211 [4].									
Note 4:	50 resource blocks are allo		ub-frames 4.9	and 41					
	resource blocks (RB0–RB								
	in sub-frame 0 and the Dw								
Note 5:									
	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					
Reference			R.50 TDD				
	pandwidth	MHz	10				
	resource blocks		50 (Note 4)				
	wnlink Configuration (Note		1				
3)							
	subframes per Radio		3+2				
Frame (D							
Modulatio			QPSK				
	oding Rate		1/3				
Informatio	on Bit Payload						
	-Frames 4,9 (non CSI-RS	Bits	3624				
subframe							
	Frames 4,9 (CSI-RS	Bits	3624				
subframe							
For Sub	-Frames 1,6		2664				
For Sub-	-Frame 5	Bits	N/A				
	-Frame 0	Bits	2984				
Number of	of Code Blocks per Sub-						
Frame							
(Note 5)							
For Sub-	-Frames 4,9 (non CSI-RS		1				
subframe	)						
For Sub-	Frames 4,9 (CSI-RS		1				
subframe							
For Sub-	-Frames 1,6		1				
For Sub-	-Frame 5		N/A				
For Sub-	-Frame 0		1				
Binary Ch	annel Bits Per Sub-Frame						
	-Frames 4,9 (non CSI-RS	Bits	12000				
subframe	)						
For Sub-F	rames 4,9 (CSI-RS	Bits	10400				
subframe							
For Sub	-Frames 1,6		7872				
For Sub	-Frame 5	Bits	N/A				
	-Frame 0	Bits	9840				
	oughput averaged over 1	Mbps	1.556				
frame							
UE Categ	lory		≥ 1				
Note 1:		CH.	-				
Note 2:	<b>D</b> ( <b>C C C C C C C C C C</b>		als and PBCH				
-	allocated as per TS 36.211		-				
Note 3:	as per Table 4.2-2 in TS 36.						
Note 4: 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.						
Note 5:	If more than one Code Bloc	k is present	t, an additional				
	CRC sequence of L = 24 Bit						
1	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.

		-	1					
	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 5 5								
Modulatio	้า		16QAM	16QAM				
	oding Rate		1/2	1/2				
	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	Dito	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				
	S subframe)		2	2				
	Frames 1,6		2	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	Divi				
Note 2:	Reference signal, synchronization	aignala and DE						
Note 2.	36.211 [4].	signals and FE		as per 13				
Note 3:	As per Table 4.2-2 in TS 36.211 [4]	1						
Note 3:	For R.45, 50 resource blocks are a		frames 10 a	nd 41				
11010 4.	resource blocks (RB0–RB20 and R							
	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				
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	e 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	ue		
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		1			1		
Subframe (Note 3)							
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 su 36.331.	bframes (#	±1/2/3/6/7/8) ar	e avail	able fo	r MBMS, in lin	e with	TS
Note 2: 2 OFDM symbols are rese 36.211.	rved for P	DCCH; and ref	erence	signal	allocated as	per TS	
Note 3: If more than one Code Blo attached to each Code Blo		•	nal CRO	C sequ	ence of $L = 24$	I Bits is	6

#### 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	ences	signal	allocated as p	oer TS	
Note 3: If more than one Code Block is preser attached to each Code Block (otherwis	•		CRC	seque	nce of L = 24	Bits is	,

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			Va	alue						
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	6.331, Up	link-Downlink	Config	uratior	n 5 is propose	d, up to	o 5
subframes (#3/4/7/8/9) are availa							
Note 2: 2 OFDM symbols are reserved for							
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.3.8.2-1: 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	ık Con	figura	tion 5 is prop	osed, ı	up to
5 subframes (#3/4/7/8/9) are available	for MBN	1S.					
Note 2: 2 OFDM symbols are reserved for PD							
Note 3: If more than one Code Block is preser	nt, an ado	ditional	CRC s	seque	nce of $L = 24$	Bits is	

attached to each Code Block (otherwise L = 0 Bit).

Parameter				PMCH			
	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)		<b></b>		•	1	11	
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 ava 2 OFDM symbols are reserved Note 3:Note 3:If more than one Code Block is attached to each Code Block (	ailable fo for PDC s present	r MBMS CH; re , an ad	S. ferenc ditiona	ce signal allocat	ed as per TS 3	36.211	

Table A.3.8.2-3: Fixed Reference C	Channel 64QAM R=2/3
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# 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 Value								
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	CH for al	l tests.							
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: Resource blocks n <sub>PRB</sub> = 02 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.									
Note 5: Resource blocks n <sub>PRB</sub> = 614,3049 are allocated for the user data in all sub-frames.									
Note 6: Resource blocks n <sub>PRB</sub> = 349 are allocated for the user data in sub-frame 5, and resource blocks n <sub>PRB</sub> = 049 in sub-									
frames 0,1,2,3,4,6,7,8,9.									
Note 7: 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 0,1,2,3,4,6,7,8,9.									
Note 8: Given per component carrier per codeword.									
Note 9: Resource blocks nPRB = 474 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 074 in sub-									

Note 9: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 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 sub-frames 0,1,2,3,4,6,7,8,9.

# A.3.9.2 TDD

Parameter Unit Value						
Reference channel		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					-
Allocated subframes per Radio Frame		8+1	8+1	8+1	4	4
(D+S)		_	-	-		
Modulation	1	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate	1					
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		-	-	-		
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						
(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		2	5	9	9	13
Binary Channel Bits Per Sub-Frame						
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		1	2	2	2	2
Max. Throughput averaged over 1 frame	Mbps	8.237	20.365	40.819	20.409	29.724
(Note 10)						
UE Category		≥ 1	≥ 2	≥2	≥2	≥ 3
Note 1: 1 symbol allocated to PDCCH for	or all tests.		-			_
Note 2: Reference signal, synchronization	on signals a	and PBCH	allocated a	s per TS 3	6.211 [4].	
Note 3: As per Table 4.2-2 in TS 36.211	[4].					
Note 4: If more than one Code Block is p		additional	CRC sequ	ence of L =	24 Bits is a	ittached
to each Code Block (otherwise L						
Note 5: Resource blocks $n_{PRB} = 02$ are	allocated f	or SIB tran	smissions	in sub-fram	ne 5 for all	
bandwidths.						
Note 6: Resource blocks $n_{PRB} = 614,30$	)49 are al	located for	the user da	ata in all su	bframes.	

Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource Note 7: blocks  $n_{PRB} = 0..49$  in sub-frames 0,3,4,6,7,8,9.

Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource Note 8: blocks  $n_{PRB} = 0..99$  in sub-frames 0,3,4,6,7,8,9.

Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in all sub-frames Note 9:

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)

Parameter	Unit				Value			
Reference channel		R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-4B
		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	64QAM	64QAM	64QAM	64QAM	64QAM	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)		-	_	-			1.0	
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								
(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)	Dits	20100	40752	03952	40752	50504	03952	02352
(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)	mopo	10.200	20.100	51.024	50.012	51.02 1	/ 1.000	01.020
UE Categories	1	≥1	≥2	≥2	≥2	≥ 3	≥ 3	≥ 4
Note 1: 1 symbol allocated to PDCCF	for all t			. –				· ·

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  $n_{PRB} = 6..14,30..49$  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	Onit	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)		011	011	011		т
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		2	5	9	9	12
For Sub-Frame 6	Bits	2	5	9	N/A	N/A
For Sub-Frame 0		2	5	9	9	13
Binary Channel Bits per Sub-Frame (subframes with PDCCH USS						
monitoring) For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400
For Sub-Frames 4,9 For Sub-Frames 3,7,8	Bits					86400 N/A
, ,	Bits	26100	43200	86400	N/A N/A	N/A N/A
For Sub-Frame 1 For Sub-Frame 5	Bits	0 26100	0 40176	0 82512	58320	N/A 82512
For Sub-Frame 6	Bits	26100	40176	82512	58320 N/A	N/A
For Sub-Frame 0	Bits	26100	42768	85968	56736	N/A 84384
Binary Channel Bits per Sub-Frame (subframes with EPDCCH USS	DIIS	20100	41104	04304	50750	04304
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 layers		1	2	2	2	2			
Max. Throughput averaged over 1	Mbps	8.237	20.365	40.819	20.409	29.724			
frame (Note 10)	_								
UE Category		≥ 1	≥2	≥2	≥ 2	≥ 3			
Note 1: 1 symbol allocated to PDCC	CH for all tests	i.							
Note 2: Reference signal, synchron	zation signals	and PBCH a	llocated as pe	r TS 36.211 [4	·].				
Note 3: As per Table 4.2-2 in TS 36	As per Table 4.2-2 in TS 36.211 [4].								
Note 4: If more than one Code Bloc	k is present, a	n additional C	RC sequence	of L = 24 Bits	is attached to	each Code			
Block (otherwise $L = 0$ Bit).									
Note 5: Resource blocks $n_{PRB} = 02$	are allocated	for SIB trans	missions in su	b-frame 5 for a	all bandwidths.				
Note 6: Resource blocks $n_{PRB} = 61$	4,3049 are a	allocated for th	ne user data in	all subframes	S.				
Note 7: Resource blocks n <sub>PRB</sub> = 34	9 are allocate	ed 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: Resource blocks $n_{PRB} = 49$	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	'1 are allocate	ed for the user	data in all sub	o-frames					
Note10: Given per component carrie	r per codewo	rd.							

# 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	
ICC.01 DD	TUU	10	0		2 CSI-RS	MCS.12	0	1	
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			I	1 ••	Γ		Γ	
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			
RC.11 TDD	TDD	10	50	Note 3	Non CSI-RS	MCS.5	10	1	
		-			2 CSI-RS	MCS.6	-		
1 CRS Port	+ CSI-RS	+ CSI-IM				-		-	
RC.13 FDD	FDD	10	50	_	Non CSI- RS/IM	MCS.3	8	1	
NO. 13 F DD		10	50		CSI- RS/IM	N/A	U		
					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							
					Non CSI-RS	MCS.5			
RC.10 FDD	FDD	10	50	-	4 CSI-	MCS.8	8	1	

#### 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	
RC.12 FDD	FDD	10	6		Non CSI- RS/IM	MCS.13	8	1	
KG. 12 FDD		0		CSI- RS/IM	N/A	0			
RC.12 TDD	TDD	10	6	Note 3	Non CSI- RS/IM	MCS.13	10	1	
RC.12 TDD	סטו	10	0	NOLE 3	CSI- RS/IM	N/A	10		
		allocated to							
Note 2: For FDD only subframes 1, 2, 3, 4, 6, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.									

Note 3: TDD UL-DL configuration as specified in the individual tests.

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.

Note 6: Centered within the Transmission Bandwidth Configuration (Figure 5.6-1).

Note 7: Only subframes 2, 3, 4, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.
 Note 8: The number of HARQ processes is 10 for TDD UL/DL configuration 2 and 7 for TDD UL/DL 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

ETSI

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)

C	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	0.4551	0.5537	0.6504	0.7539	0.8525	0.9258	Notes
М	odulati	on	OOR			QP	SK			1	6QAN	Λ			64Q	MAA			
MCS Scheme	PRB	Available RE-s								Imo	s								
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:	<ul> <li>a symbols allocated to PDCCH.</li> <li>b Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or</li> </ul>																		
	#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								
	PDSCH							
		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:	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 $\gamma_{\scriptscriptstyle PRB}$ 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	5	1-4,6-9							
		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			Subfi	ame		PDSCH Data	PMCH Data
$n_P$	RB	0	5	4, 9	1 – 3, 6 – 8	Data	
1 –	- 49 0		0 (Allocation: all empty PRB-s)		N/A	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	Duiu			
First unallocated PRB – Last unallocated PRB		0 (Allocation: all empty PRB-s) N/A		N/A	Note 1	N/A		
First una PR – Last una PR	B llocated	N/A	Note 2					
Note 1:				ssigned to an arbitrary numb ransmitted over the OCNG P				
		•		nich is QPSK modulated. The				
Note 2:	Each ph each PR measure	B shall be unce ement. The MB	block (PRB) is orrelated with orrelated with or SFN data shall	s assigned to MBSFN transn data in other PRBs over the p l be QPSK modulated. PMCI s only in the first symbol of tl	period of ar H subframe	ny es shall		
	paramet	ter $\gamma_{\scriptscriptstyle PRB}$ 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 $\gamma_{\scriptscriptstyle PRB}$ [di	B]						
	0 5 1-4,6-9								
		Allocation		Data					
First u	Inallocated PRB	First unallocated PRB	First unallocated PRB						
Last u	- Inallocated 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:	ote 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	intenna 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 13.	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			
(Last allo	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 scal	he 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					
	•	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					
0 – (PF	$\operatorname{RB} N_{Start,1} - 1$ )	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$			
				PDSCH Data		
(PRB N <sub>E</sub>	$E_{nd,(m-1)}$ ) – (PRB	$(PRBN_{End,(m-1)}) - (PRB$	$(PRBN_{End,(m-1)}) - (PRB$			
Ν	$S_{tart,m} - 1$ )	$N_{Start,m} - 1$ )	$N_{Start,m} - 1$ )			
(PRB <i>N</i>	 / <sub>End,M</sub> ) – (PRB	 (PRB $N_{End,M}$ ) – (PRB	 (PRB $N_{End,M}$ ) – (PRB			
	N <sub>RB</sub> -1)	$N_{RB} - 1$ )	$N_{RB} - 1$ )			
	0	0	0	Note 1		
Note 1:		ource blocks are assigned to a mitted over the OCNG PDSCHs				
	modulated. The pa	he power of PDSCH.				
Note 2:	ote 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					
		ort separately, so the transmit p	ower is equal between all the tr are specified in section 7.1 in			

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: 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 discontinuous in frequency domain where there are *M* unallocated PRB blocks labled from 1-st block to *M*-th block (*M*>1) and the *m*-th block starts with PRB  $N_{Start,m}$  and end with PRB  $N_{End,m}$ , orwhen the unallocated area is continuous in frequency domain where M=1 (one sided). The system bandwidth starts with RPB 0 and ends with  $N_{RB} - 1$ .  $N_{End,M}$  should be equal to or less than  $N_{RB} - 1$ .

		Relative power level $\gamma_{\scriptscriptstyle PRB}$ [d	B]			
		Subframe				
	0 5 1-4,6-9					
		Allocation				
(PRB N <sub>Star</sub> <i>m</i> -th un (PRI PRI <i>M</i> -th un (PRE	hallocated PRB $_{rr,1} \sim PRB N_{End,1}$ )  hallocated PRB B $N_{Start,m} \sim$ B $N_{End,m}$ )  hallocated PRB B $N_{Start,M} \sim$ B $N_{End,M}$ )	1-st unallocated PRB (PRB $N_{Start,1} \sim PRB N_{End,1}$ )  m-th unallocated PRB (PRB $N_{Start,m} \sim$ PRB $N_{End,m}$ )  M-th unallocated PRB (PRB $N_{Start,M} \sim$ PRB $N_{End,M}$ )	1-st unallocated PRB (PRB $N_{Start,1} \sim PRB N_{End,1}$ )  m-th unallocated PRB (PRB $N_{Start,m} \sim PRB N_{End,m}$ )  M-th unallocated PRB (PRB $N_{Start,M} \sim$ PRB $N_{End,M}$ )	PDSCH Data		
	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 $\gamma_{PRB}$ is used to scale the power of PDSCH.					
	<ul> <li>Note 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.</li> <li>Note 3: The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.</li> </ul>					

#### Table A.5.1.8-1: OP.8 FDD: Dynamic OCNG FDD Pattern

## 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 5		5	3, 4, 7, 8, 9 and 6 (as normal subframe) <sup>Note 2</sup>	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	located 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 b				
	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:	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 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  $N_{_{RB}}-1$ .

		Relative power	level $\gamma_{\scriptscriptstyle PRB}$ [dB]		PDSCH Data	
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	Note 1	
Note 1:				rtual UEs with one PDSCH p oseudo random data, which i		
	modulated. The	parameter $\gamma_{\scriptscriptstyle PRB}$ is used to set	cale the power of PDSCH.			
Note 2:	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 t					
	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

Allocation $n_{PRB}$			Relative power				
			Subf	PDSCH Data	PMCH Data		
		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 - 4	0 – 49 N/A N/A 0 N/A		N/A	N/A	Note 3		
Note 1: Note 2:	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. 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. 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. If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all						
N/A	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.						

#### Table A.5.2.3-1: OP.3 TDD: OCNG TDD Pattern 3 for 5ms downlink-to-uplink switch-point periodicity

# 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				
Allocation		Subframe (	PDSCH Data	PMCH Data		
n <sub>PRB</sub>	0 and 6 (as normal subframe)	1 (as special subframe)	5	3, 4, 7 – 9	. Been Bulu	- morr Butu

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
	These physical reso virtual UE; the data					
v	vhich is QPSK mod	dulated. The parar	neter $\gamma_{\scriptscriptstyle PRB}$ is used	to scale the powe	er of PDSCH.	
L						
Note 3: I b b	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 M	Not Applicable					

### 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		5	3, 4, 7, 8, 9 and 6 (as normal subframe) <sup>Note 2</sup>	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	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 b				
	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:	bite 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 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.5.2.5-1: 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)						
	0	5	3, 4, 6, 7, 8, 9	1,6		
			(6 as normal subframe)	(6 as special subframe)		
		Alloc	ation			
0 – (Firs	t allocated PRB	0 – (First allocated PRB	0 – (First allocated PRB	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		
	located PRB of	(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of		
	ock +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 $\gamma_{\scriptscriptstyle PRB}$ is used to see	cale the power of PDSCH.			
Note 2:	e 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					
	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.5.2.7 OCNG TDD pattern 7: dynamic OCNG TDD 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.

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	•	
$0 - (PRB N_{Start,1} - 1)$		0 – (PRB $N_{Start,1}$ –1)	$0 - (PRB N_{Start,1} - 1)$	0 – (PRB $N_{Start,1}$ –1 )	
(PRB N <sub>End</sub> ,(r	<sub>n-1)</sub> ) –	$(PRBN_{End,(m-1)})$ –	$(PRBN_{End,(m-1)}) -$	$(PRBN_{End,(m-1)})$ –	
(PRB $N_{Start,m} - 1$ )		(PRB $N_{Start,m} - 1$ )	(PRB $N_{Start,m} - 1$ )	(PRB $N_{Start,m} - 1$ )	
$(PRBN_{End,M}) - (PRB$		$(PRBN_{End,M}) - (PRB$	$(PRBN_{End,M})$ – $(PRB$	$(PRBN_{End,M}) - (PRB$	
$N_{RB} - 1$ )		$N_{RB} - 1$ )	$N_{RB} - 1$ )	$N_{RB} - 1$ )	
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: 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 $\gamma_{PRB}$ appl					
each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS us in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					

#### Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

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# A.5.2.8 OCNG TDD pattern 8: 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 discontinuous in frequency domain where there are *M* unallocated PRB blocks labled from 1-st block to *M*-th block (*M*>1) and the *m*-th block starts with PRB  $N_{Start,m}$  and end with PRB  $N_{End,m}$ , or when the unallocated area is continuous in frequency domain where M=1 (one sided). The system bandwidth starts with RPB 0 and ends with  $N_{RB} - 1$ .  $N_{End,M}$  should be equal to or less than  $N_{RB} - 1$ .

ETSI

		Relative power level $\gamma_{\scriptscriptstyle PRB}$ [d	B]				
	Subframe						
0		5	1-4,6-9				
	Allocation						
1-st unallocated PRB (PRB $N_{Start,1} \sim PRB N_{End,1}$ )  m-th unallocated PRB (PRB $N_{Start,m} \sim$ PRB $N_{End,m}$ )  M-th unallocated PRB (PRB $N_{Start,M} \sim$ PRB $N_{End,M}$ )		1-st unallocated PRB (PRB $N_{Start,1} \sim PRB N_{End,1}$ )  m-th unallocated PRB (PRB $N_{Start,m} \sim$ PRB $N_{End,m}$ )  M-th unallocated PRB (PRB $N_{Start,M} \sim$ PRB $N_{End,M}$ )	$ \begin{array}{c} 1 \text{-st unallocated PRB} \\ (\text{PRB } N_{Start,1} \sim \text{PRB } N_{End,1}) \\ \text{d PRB} \\ m^{\sim} \\ m^{\circ} \\ m^{\circ} \\ \text{d PRB} \\ \text{d PRB} \\ \text{d PRB} \\ \text{d PRB} \\ \text{d PRB} \\ \text{M}^{\sim} \\ \text{PRB } N_{Start,M} \sim \\ \text{PRB } N_{End,M} \\ \text{d PRB} \\ d PRB$				
	0	0	0	Note 1,2,3			
Note 1:	per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is 16QAM modulated. The parameter $\gamma_{PRB}$ is used to scale the power of PDSCH.						
Note 2:	<ul> <li>Note 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.</li> <li>Note 3: The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.</li> </ul>						

## 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	(ETU)	
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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

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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

ſ	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 & 0.9583 & 0.8894 & 1.0000 & 0.8894 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8894 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 0.000 \\ 0.8090 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 0.000 \\ 0.8090 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 0.000 \\ 0.8090 & 0.8090 & 0.8090 & 0.8090 & 0.8090 & 0.8000 & 0.8000 & 0.8000 & 0.8000 & 0.8000 & 0.8000 & $												
4x4 case	$R_{\text{high}} = \begin{bmatrix} 1.0000\ 0.9882\ 0.9541\ 0.8999\ 0.9882\ 0.9767\ 0.9430\ 0.8894\ 0.9541\ 0.9430\ 0.9105\ 0.8587\ 0.8999\ 0.8894\ 0.8587\ 0.8099\\ 0.9882\ 1.0000\ 0.9882\ 0.9541\ 0.9767\ 0.9882\ 0.9767\ 0.9430\ 0.9430\ 0.9541\ 0.9430\ 0.9105\ 0.8587\ 0.8999\ 0.8894\ 0.8587\\ 0.9541\ 0.9882\ 1.0000\ 0.9882\ 0.9430\ 0.9767\ 0.9882\ 0.9767\ 0.9105\ 0.9430\ 0.9541\ 0.9430\ 0.9541\ 0.9430\ 0.8587\ 0.8894\ 0.8999\ 0.8894\\ 0.8999\ 0.9541\ 0.9882\ 1.0000\ 0.9882\ 0.9767\ 0.9882\ 0.9767\ 0.9105\ 0.9430\ 0.9541\ 0.95$												

Table B.2.3.2-2: MIMO correlation matrices for high correlation

1x2 case						N/A								
2x2 case					R <sub>medium</sub>	0.9 1								
4x2 case		R <sub>medium</sub> =	$= \left(\begin{array}{c} 1.000\\ 0.900\\ 0.870\\ 0.78\\ 0.580\\ 0.522\\ 0.300\\ 0.270\end{array}\right)$	00       1.00         48       0.78         73       0.87         56       0.52         71       0.58         00       0.27	00 0.78 73 1.00 48 0.90 71 0.87 56 0.78 00 0.55	873         0.874           000         0.900           000         1.000           748         0.78	48       0.5         00       0.8         00       0.7         73       1.0         48       0.9         71       0.8	5271 8748 7873 0000 9000 8748	0.5271 0.5856 0.7873 0.8748 0.9000 1.0000 0.7873 0.8748	<ul> <li>0.27</li> <li>0.58</li> <li>0.52</li> <li>0.52<th>700 856 271 748 873 000</th><th>0.2700 0.3000 0.5271 0.5856 0.7873 0.8748 0.9000 1.0000</th><th></th><th></th></li></ul>	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         0.9882           0.9882         1.0000           0.9541         0.9882           0.8999         0.9541           0.8747         0.8645           0.8747         0.8645           0.8347         0.8645           0.7872         0.8347           0.5855         0.5787           0.5787         0.5855           0.5270         0.5588           0.3000         0.2965           0.2965         0.3000           0.2862         0.2905	0.9882         0.9           1.0000         0.9           0.9882         1.00           0.8347         0.7           0.8645         0.8           0.8747         0.8           0.8645         0.8           0.5588         0.5           0.5787         0.5           0.5787         0.5           0.5787         0.5           0.28662         0.2           0.2965         0.2           0.3000         0.2	641         0.8645           382         0.8347           000         0.7872           372         1.0000           347         0.9882           545         0.9541           747         0.8999           270         0.8747           588         0.8645           787         0.8347           3855         0.7872           700         0.5855           362         0.5787           965         0.5588	0.8747         0           0.8645         0           0.8347         0           0.9882         0           1.0000         0           0.9582         1           0.9541         0           0.8645         0           0.8645         0           0.8645         0           0.8645         0           0.8645         0           0.8747         0           0.8645         0           0.5787         0           0.5785         0           0.5787         0	0.8645         0.8347           0.8747         0.8645           0.8747         0.8645           0.8645         0.8747           0.9541         0.8999           0.9882         0.9541           0.0000         0.9882           0.9882         1.0000           0.8347         0.7872           0.8645         0.8347           0.8747         0.8645           0.8645         0.8747           0.8645         0.8747           0.5588         0.5276           0.5787         0.5588           0.5785         0.5787	<ul> <li>0.5787</li> <li>0.5588</li> <li>0.5270</li> <li>0.8747</li> <li>0.8645</li> <li>0.7872</li> <li>1.0000</li> <li>0.9882</li> <li>0.9541</li> <li>0.8999</li> <li>0.8747</li> <li>0.8645</li> <li>0.8347</li> </ul>	0.5855 0.5787 0.5588 0.8645 0.8747 0.8645 0.8347 0.9882 1.0000 0.9882 0.9541 0.8645 0.8747 0.8645	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 0.5588 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.2.3.2-3: M	MIMO correlation	matrices for	medium o	orrelation

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,  $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & I \end{pmatrix}$ .

For 8-antenna transmitter using four pairs of cross-polarized antenna elements, 
$$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$$

#### 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.

Table B.2.3A.3-1	
------------------	--

High spatial correlation											
0.9	0.9	0.3									
Note 1: Value of α applies when more than one pair of cross-polarized antenna elements at eNB side.											
Note 2: Value of $\beta$ applies when r	nore than one pair of cross-polarized ar	ntenna 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	correlation	matrices	for high	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
9x2	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

$$y = HD_{\theta_{L}}Wx + n$$

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 <sup>-3</sup>		

### 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)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), t > 2D_s/v$$
(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.

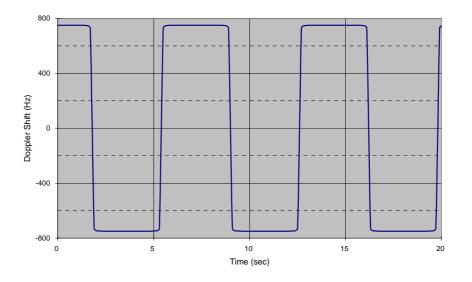


Figure B.3-1: Doppler shift trajectory

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:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i) y^{(p)}(i) .$$

# 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 $E_{\rm RS}$ / $I_{or}$		0 dB	

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, unless otherwise stated.

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.

urpose 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 <i>p</i>
Energy per resource element EPRE		Test specific	1. The complex-valued symbols $y^{(p)}(i)$ and
			$a_{k,l}^{\left( p ight) }$ 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
FBCH	PBCH_RB	dB	ρ <sub>B</sub>	Note 1
PSS	PSS_RA	dB	ρΑ	Note 1
SSS	SSS_RA	dB	ρΑ	Note 1
PCFICH	PCFICH_RB	dB	ρ <sub>B</sub>	Note 1
PHICH	PHICH_RA	dB	ρ <sub>Α</sub>	Note 1
	PHICH_RB	dB	ρв	Note 1
PDCCH	PDCCH_RA	dB	ρΑ	Note 1
	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: $-\infty$ dB is allocated for this channel in this test.				

Physical 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	ρ <sub>Α</sub>	ρ <sub>Α</sub>	
SSS	SSS_RA	dB	ρΑ	ρΑ	
PCFICH	PCFICH_RB	dB	ρ <sub>в</sub>	Note 1	
PHICH	PHICH_RA	dB	ρ <sub>Α</sub>	Note 1	
РПСП	PHICH_RB	dB	ρ <sub>B</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	
FDSCH	PDSCH_RB	dB	N/A	Note 1	
OCNG	OCNG_RA	dB	ρ <sub>Α</sub>	Note 1	
UCING	OCNG_RB	dB	ρ <sub>Β</sub>	Note 1	

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).

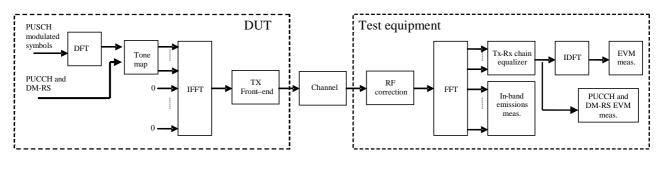


Figure F.1-1: EVM measurement points

## 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  $\Delta \tilde{t}$ .

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  $\Delta \tilde{c} + \alpha - \left\lfloor \frac{W}{2} \right\rfloor$  or  $\Delta \tilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$ , where  $\alpha = 0$  if W is odd and  $\alpha = 1$  if W is even. The EVM analyses shall then

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.

#### F.5.2 Window length

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.

#### F.5.3 Window length for normal CP

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	160	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.Note 2:These percentages are informative and apply to symbols 1 through 6. Symbol 0 has a longer CP and therefore a lower percentage.						

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	2 6240		6144	98.5%		
3	3 21024		20928	99.5%		
4	448	4096	432	96.4%		
	Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed					
Note 2: The use of other FFT sizes is possible as long as appropriate scaling of the window length is applied						
Note 3: T	These percentages are informative					

## 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

			annel bar				<b>.</b>
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]			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
10			1	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
-				100			100
33				[ 102]			TDD
				[-102]			
34 35				[-102]			TDD TDD
				[-102]			
36				[-102]			TDD
37				[-102]			TDD
38				[-102]			TDD
39				[-102]			TDD
40				[-102]			TDD
42				[-102]			TDD
43				[-102]			TDD
44				[-102]	in alarraa (		TDD
Note 2:	The transmitter Reference meas OP.1 FDD/TDD	surement cl as describe	hannel is ( ed in Anne	G.3 with on ex A.5.1.1//	e sided dy		IG Patterr
Note 4:	The signal powe For the UE whic evel is FFS.				nd 9 the ret	ference ser	nsitivity
Note 5:	For the UE whic evel is FFS.	h supports	both Band	11 and Ba	and 21 the	reference s	sensitivity

Table G.2-1: Reference	sensitivity QPSK P <sub>SENS</sub>
------------------------	------------------------------------

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 B	and / Cha	annel ban	dwidth / N	IRB / Dupl	ex mode	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	1			[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	1			50			TDD								
39	1			50			TDD								
40	<u> </u>			50			TDD								
40	<u> </u>			50			TDD								
43	<u> </u>			50			TDD								
44	<u> </u>			50			TDD								
Note 1:	L The UL reso downlink op	erating ba	and but co	e located a nfined with	in the trans	smission ba	the								
Note 2:	configuration For the UE v uplink config	which sup guration fo	ports both	Band 11 a	and Band 2 ty is FFS.	21 the minir									
I	For Band 20 blocks shall bandwidth, t	be locate	d at RBsta	art_11 and	l in the cas	e of 20MHz	z channel								

 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
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# 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	Va	Value				
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 symb	ools allocated	to PDCCH			
Note 2: For 1.4MHz, no data shall be sche insufficient PDCCH performance							
Note 3: Reference signal, Synchronization	n signals and F	BCH allocated as per TS	36.211 [4]				
Note 4: If more than one Code Block is pr each Code Block (otherwise L = 0	esent, an addi			tached to			
Note 5: As per Table 4.2-2 in TS 36.211 [	4]						
Note 6: Redundancy version coding sequ		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
			44 48r3			Addition of Band 17	8.3.0
09-2008	RP#41	RP-080731					8.3.0
09-2008	RP#41	RP-080731	50			Alignment of the UE ACS requirement	
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	1	1	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	1	1	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		1	LTE UE transmitter intermodulation	8.4.0
12-2008	RP#42	RP-080910	91		1	Update of Clause 8	8.4.0
12-2008	RP#42	RP-080910 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		1	CR UE ACS test frequency offset	8.4.0
12-2008	RP#42 RP#42	RP-080911	65	+	+	Correction of spurious response parameters	8.4.0
	111 #44	111-000911	1 00	1	1		0.7.0

#### 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	RP#42	RP-080912	73r1	Addition of 64QAM DL referenbce measurement channel	8.4.0
12-2008	RP#42	RP-080912	74r1	Addition of UL Reference Measurement Channels	8.4.0
12-2008	RP#42	RP-080912	104	Reference measurement channels for PDSCH performance requirements (TDD)	8.4.0
12-2008	RP#42	RP-080913	68	MIMO Correlation Matrix Corrections	8.4.0
12-2008	RP#42	RP-080915	67	Correction to the figure with the Transmission Bandwidth configuration	8.4.0
12-2008	RP#42	RP-080916	77	Modification to EARFCN	8.4.0
12-2008	RP#42	RP-080917	85r1	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 8.5.0
03-2009	RP#43	RP-090170	119	Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts Removal of "Out-of-synchronization handling of output power"	8.5.0
03-2009	RP#43	RP-090170	120	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
03-2009	RP#43	RP-090172	160r1	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-090173	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
03-2009	RP#43	RP-090369	161	Clarification on OCNG CQI reference measurement channels	8.5.0
			164		8.5.0
03-2009	RP#43	RP-090369	111	PUCCH 1-1 Static Test Case	
03-2009	RP#43	RP-090369		Reference Measurement Channel for TDD	8.5.0
03-2009	RP#44	ļ		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
	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
)5-2009	RP#44	RP-090540	179	Correction of SRS requirements. (Technically Endorsed CR in R4-50bis - R4-091426)	8.6.0
)5-2009	RP#44	RP-090540	186	Clarification for EVM. (Technically Endorsed CR in R4-50bis - R4-091512)	8.6.0
)5-2009	RP#44	RP-090540	187	Removal of [] from band 17 Refsens values and ACS offset frequencies	8.6.0
)5-2009	RP#44	RP-090540	191	Completion of band17 requirements	8.6.0
5-2009	RP#44	RP-090540	192	Removal of 1.4 MHz and 3 MHz bandwidths from bands 13, 14 and 17.	8.6.0
5-2009	RP#44	RP-090540	223	CR: 64 QAM EVM	8.6.0
)5-2009	RP#44	RP-090540	201	CR In-band emissions	8.6.0
5-2009	RP#44	RP-090540	203	CR EVM exclusion period	8.6.0
5-2009	RP#44	RP-090540	204	CR In-band emissions timing	8.6.0
5-2009	RP#44	RP-090540	206	CR Minimum Rx exceptions	8.6.0
5-2009	RP#44	RP-090540	207	CR UL DM-RS EVM	8.6.0
5-2009	RP#44	RP-090540	218r1	A-MPR table for NS 07	8.6.0
5-2009	RP#44	RP-090540	205r1	CR In-band emissions in shortened subframes	8.6.0
5-2009	RP#44	RP-090540	200r1	CR PUCCH EVM	8.6.0
5-2009	RP#44	RP-090540	178r2	No additional emission mask indication. (Technically Endorsed CR in R4-50bis - R4-091421)	8.6.0
5-2009	RP#44	RP-090540	220r1	Spectrum emission requirements for band 13	8.6.0
)5-2009	RP#44	RP-090540	197r2	CR on aggregate power tolerance	8.6.0
5-2009	RP#44	RP-090540	196r2	CR: Rx IP2 performance	8.6.0
5-2009	RP#44	RP-090541	198r1	Maximum output power relaxation	8.6.0
5-2009	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
)5-2009	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
5-2009	RP#44	RP-090542	182	OCNG Patterns for Single Resource Block FRC Requirements. (Technically Endorsed CR in R4-50bis - R4-091504)	8.6.0
)5-2009	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
)5-2009	RP#44	RP-090543	199	CQI requirements under AWGN conditions	8.6.0
5-2009	RP#44	RP-090543	188r1	Adaptation of UL-RMC-s for supporting more UE categories	8.6.0
5-2009	RP#44	RP-090543	193r1	Correction of the LTE UE downlink reference measurement channels	8.6.0
5-2009	RP#44	RP-090543	184r1	Requirements for frequency non-selective fading tests. (Technically Endorsed CR in R4-50bis - R4-091506)	8.6.0
5-2009	RP#44	RP-090543	185r1	Requirements for PMI reporting. (Technically Endorsed CR in R4-50bis - R4-091510)	8.6.0
5-2009	RP#44	RP-090543	221r1	Correction to DL RMC-s for Maximum input level for supporting more UE-Categories	8.6.0
5-2009	RP#44	RP-090543	216	Addition of 15 MHz and 20 MHz bandwidths into band 38	8.6.0
5-2009	RP#44	RP-090559	180	Introduction of Extended LTE800 requirements. (Technically Endorsed CR in R4-50bis - R4-091432)	9.0.0
)9-2009	RP#45	RP-090826	239	A-MPR for Band 19	9.1.0
9-2009	RP#45	RP-090822	225	LTE UTRA ACLR1 centre frequency definition for 1.4 and 3 MHz BW	9.1.0
9-2009	RP#45	RP-090822	227	Harmonization of text for LTE Carrier leakage	9.1.0
9-2009	RP#45	RP-090822	229	Sensitivity requirements for Band 38 15 MHz and 20 MHz bandwidths	9.1.0
9-2009	RP#45	RP-090822	236	Operating band edge relaxation of maximum output power for Band 18 and 19	9.1.0
)9-2009	RP#45	RP-090822	238	Addition of 5MHz channel bandwidth for Band 40	9.1.0
9-2009	RP#45	RP-090822	245	Removal of unnecessary requirements for 1.4 and 3 MHz bandwidths on bands 13 and 17	9.1.0
9-2009	RP#45	RP-090877	261	Correction of LTE UE ACS test parameter	9.1.0
9-2009	RP#45	RP-090877	263R1	Correction of LTE UE ACLR test parameter	9.1.0
)9-2009	RP#45	RP-090877	286	Uplink power and RB allocation for receiver tests	9.1.0
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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 Transmit power: removal of TC and modification of REFSENS	9.1.0
09-2009	RP#45	RP-090877	332	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
09-2009	RP#45	RP-090878	247	Reference measurement channel for multiple PMI requirements           CQI reporting test for a scenario with frequency-selective	9.1.0
09-2009	RP#45	RP-090878	290	interference	9.1.0
09-2009	RP#45	RP-090878	265R2	CQI reference measurement channels	9.1.0
09-2009	RP#45	RP-090878	321R1	CR RI Test Correction of parameters for demodulation performance	9.1.0
09-2009	RP#45	RP-090875	231	requirement	9.1.0
09-2009	RP#45	RP-090875	241R1	UE categories for performance tests and correction to RMC references	9.1.0
09-2009	RP#45	RP-090875	333	Clarification of Ês definition in the demodulation requirement	9.1.0
09-2009	RP#45	RP-090875	326	Editorial corrections and updates to PHICH PBCH test cases.	9.1.0
09-2009	RP#45	RP-090875	259R3	Test case numbering in section 8 Performance tests	9.1.0
12-2009	RP-46	RP-091264	335	Test case numbering in TDD PDSCH performance test (Technically endorsed at RAN 4 52bis in R4-093523)	9.2.0
12-2009	RP-46	RP-091261	337	Adding beamforming model for user-specfic reference signal (Technically endorsed at RAN 4 52bis in R4-093525)	9.2.0
12-2009	RP-46	RP-091263	339R1	Adding redundancy sequences to PMI test (Technically 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 Corrections to RMC-s for Maximum input level test for low UE	9.2.0
12-2009 12-2009	RP-46 RP-46	RP-091264 RP-091261	373R1 377	categories Correction of UE-category for R.30	9.2.0 9.2.0
12-2009	RP-46 RP-46	RP-091261 RP-091286	378	Introduction of Extended LTE1500 requirements for TS36.101	9.2.0
12-2009	RP-46	RP-091262	384	CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from 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
40.0000	RP-46	RP-091262	404R3	CR Power control exception R8	9.2.0
12-2009 12-2009	RP-46	RP-091262	416R1	Relative power tolerance: special case for receiver tests	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 Transport format and test setup updates to frequency-selective	9.2.0
12-2009	RP-46	RP-091263	434	interference CQI tests	9.2.0
12-2009 12-2009	RP-46 RP-46	RP-091263 RP-091261	436 438	CR RI reporting configuration in PUCCH 1-1 test Addition of R.11-1 TDD references	9.2.0 9.2.0
12-2009	RP-46	RP-091201 RP-091292	439	Performance requirements for LTE MBMS	9.2.0
12-2009	RP-46	RP-091262	442R1	In Band Emissions Requirements Correction CR	9.2.0
12-2009	RP-46	RP-091262	444R1	PCMAX definition	9.2.0
03-2010	RP-47	RP-100246	453r1	Corrections of various errors in the UE RF requirements	9.3.0
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 MBSFN.	9.3.0
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
)3-2010	RP-47	RP-100250	469r1	Corrections of some CSI test parameters	9.3.0
)3-2010	RP-47	RP-100251	456r1	TBS correction for RMC UL TDD 16QAM full allocation BW 1.4 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	RP-100619	547r1	Correction of antenna configuration and beam-forming model for DRS	9.4.0
06-2010				CR: Corrections on MIMO demodulation performance	9.4.0
	RP-48	RP-100619	536r1	requirements	
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
16 2040	RP-48	RP-100619	568	control channel errors	
06-2010 06-2010	RP-48	RP-100619 RP-100620	566	Correction of the UE output power definition for RX tests	9.4.0 9.4.0
06-2010 06-2010	RP-48 RP-48	RP-100620 RP-100620	505r1 521	Fading CQI requirements for TDD mode Correction to FRC for CQI index 0	9.4.0
06-2010 06-2010	RP-48	RP-100620 RP-100620	521 516r1	Correction to CQI test configuration	9.4.0
06-2010	111-40	111110020		Correction of CQI and PMI delay configuration description for	
	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	RP-48	RP-100630	508r1	Addition of PDSCH TDD DRS demodulation tests for Low UE categories	9.4.0
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06-2010	RP-48	RP-100630	539	Specification of minimum performance requirements for low UE category	9.4.0

				category TDD CRS single-antenna port tests	
06-2010				Introduction of sustained downlink data-rate performance	9.4.0
	RP-48	RP-100631	549r3	requirements	
06-2010	RP-48	RP-100683	530r1	Band 20 Rx requirements	9.4.0
09-2010	RP-49	RP-100920	614r2	Add OCNG to MBMS requirements	9.5.0
09-2010	RP-49	RP-100916	599	Correction of PDCCH content for PHICH test	9.5.0
09-2010	RP-49	RP-100920	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
09-2010				Correction on single-antenna transmission fixed reference	
	RP-49	RP-100920	601	channel	9.5.0
09-2010	DD 40	DD 400044	005	Reference sensitivity requirements for the 1.4 and 3 MHz	0.5.0
00.0040	RP-49 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		DD 400040	014	Correction of references in section 10 (MBMS performance	050
00.0040	RP-49 RP-49	RP-100919	611	Band 13 and Band 14 spurious emission corrections	9.5.0
09-2010		RP-100914	613		9.5.0
09-2010 09-2010	RP-49 RP-49	RP-100919 RP-100926	617r1 576r1	Rx Requirements	9.5.0 9.5.0
09-2010	RP-49 RP-49	RP-100926 RP-100920	576F1 582r1	Clarification on DL-BF simulation assumptions Introduction of additional Rel-9 scenarios	9.5.0
09-2010	RP-49 RP-49	RP-100920	575r1	Correction to band 20 ue to ue Co-existence table	9.5.0
09-2010	RP-49 RP-49	RP-100925	57511 581r1	Test configuration corrections to CQI reporting in AWGN	9.5.0
09-2010					
	RP-49 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	RP-49	PD 100000	586	Addition of minimum performance requirements for low UE	0.5.0
09-2010	RP-49 RP-49	RP-100920 RP-100914	586 590r1	Category TDD tests Downlink power for receiver tests	9.5.0 9.5.0
09-2010	RP-49 RP-49	RP-100914 RP-100920		OCNG use and power in beamforming tests	9.5.0
09-2010	RP-49 RP-49	RP-100920	591 593	Throughput for multi-datastreams transmissions	9.5.0
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-49	RP-100914	596r2	CR LTE_TDD_2600_US spectrum band definition additions to	10.0.0
09-2010	RP-49	RP-100927	29012	TS 36.101	10.0.0
12-2010	RP-50	RP-101309	680	Demodulation performance requirements for dual-layer	10.1.0
12-2010	KF-30	KF-101309	000	beamforming	10.1.0
12-2010	RP-50	RP-101325	672	Correction on the statement of TB size and subband selection in	10.1.0
12-2010	KF-50	KF-101525	072	CSI tests	10.1.0
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
12-2010	KI -50	101525	05511	(Rel-10)	10.1.0
12-2010	RP-50	RP-101330	645	EVM window length for PRACH	10.1.0
12-2010	RP-50	RP-101330	649	Removal of NS signalling from TDD REFSENS tests	10.1.0
12-2010	RP-50	RP-101330	642r1	Correction of Note 4 In Table 7.3.1-1: Reference sensitivity	10.1.0
12 2010	111 30	101000	04211	QPSK PREFSENS	10.1.0
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	RP-50	RP-101341	673r1	Correction on MBMS performance requirements	10.1.0
12-2010	RP-50	RP-101349	667r3	CR Removing brackets of Band 41 reference sensitivity to TS	10.1.0
				36.101	
12-2010	RP-50	RP-101356	666r2	Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for TS	10.1.0
				36.101	
12-2010	RP-50	RP-101359	646r1	CR for CA, UL-MIMO, eDL-MIMO, CPE	10.1.0
12-2010	RP-50	RP-101361	620r1	Introduction of L-band in TS 36.101	10.1.0
12-2010	RP-50	RP-101379	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
03-2011	RP-51	RP-110352	707r1	REFSENSE in lower SNR	10.2.0
03-2011	RP-51	RP-110338	710	PMI performance: Power settings and precoding granularity	10.2.0
03-2011	RP-51	RP-110359	715r2	Definition of configured transmitted power for Rel-10	10.2.0
03-2011	RP-51	RP-110359	717	Introduction of requirement for adjacent intraband CA image	10.2.0
				rejection	
03-2011	RP-51	RP-110343	719	Minimum requirements for the additional Rel-9 scenarios	10.2.0
03-2011	RP-51	RP-110343	723	Corrections to power settings for Single layer beamforming with	10.2.0
				simultaneous transmission	
03-2011	RP-51	RP-110343	726r1	Correction to the PUSCH3-0 subband tests for Rel-10	10.2.0
03-2011	RP-51	RP-110338	730	Removing the square bracket for TS36.101	10.2.0
03-2011	RP-51	RP-110349	739	Removal of square brackets for dual-layer beamforming	10.2.0
				demodulation performance requirements	
03-2011	RP-51	RP-110359	751 754r2	CR: Maximum input level for intra band CA	10.2.0
03-2011	RP-51	RP-110349		UE category coverage for dual-layer beamforming	10.2.0

00.0014		DD 440242	750-4	Further clarifications for the Custoined Dourslink Date Date Test	40.0.0
03-2011	RP-51 RP-51	RP-110343 RP-110343	756r1 759	Further clarifications for the Sustained Downlink Data Rate Test 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 3	10.3.0
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 06-2011	RP-52 RP-52	RP-110792 RP-110787	810 814	FDD MBMS performance requirements for 64QAM mode Correction on CQI mapping index of RI test	10.3.0 10.3.0
06-2011	RP-52 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	RP-52	RP-110794	828	TDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110796	829	Correction of TDD RMC for Low SNR Demodulation test	10.3.0
06-2011	RP-52	RP-110796	830	Informative reference sensitivity requirements for Low SNR for 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 beamforming category 1 UE test	10.3.0
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	10.3.0
09-2011	RP-53	RP-111248	869r1	tables Clarification on BS precoding information field for RI FDD and	10.4.0
				PUCCH 2-1 PMI tests	
09-2011	RP-53	RP-111248	872r1	CR for B14Rx requirement Rrel 10	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111248 RP-111248	890r1 893	CR to TS36.101: Correction on the accuracy test of CQI. CR to TS36.101: Correction on CQI mapping index of TDD RI	10.4.0 10.4.0
03-2011	IXI -55	111-111240	093	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 09-2011	RP-53 RP-53	RP-111262 RP-111262	926r1 927r1	Power control accuracy for intra-band carrier aggregation In-band emissions requirements for intra-band carrier	10.4.0 10.4.0
00.0011	DD 50	DD 111000	020r1	aggregation	10.4.0
09-2011	RP-53	RP-111262	930r1 848	Adding the operating band for UL-MIMO Corrections to intra-band contiguous CA RX requirements	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111265 RP-111265	848 863	Intra-band contiguous CA RX requirements	10.4.0 10.4.0
09-2011	RP-53	RP-111265	866r1	Intra-band contiguous CA KIP K requirement remement	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	RP-111680	950	Clarification on applying CSI reports during rank switching in RI FDD test - Rel-10	10.5.0
12-2011	RP-54	RP-111734	950 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 12-2011	RP-54 RP-54	RP-111690 RP-111693	960r1 962	P-MPR definition Pcmax,c Computation Assumptions	10.5.0 10.5.0

12-2011	RP-54	RP-111733	963r1	Correction of frequency range for spurious emission requirements	10.5.0
12-2011	RP-54	RP-111680	966	General review of the reference measurement channels	10.5.0
12-2011	RP-54	RP-111691	945	Corrections of Rel-10 demodulation performance requirements	10.5.0
12 2011			0-0	This CR is only partially implemented due to confliction with CR 966	10.0.0
12-2011	RP-54	RP-111684	946	Corrections of UE categories for Rel-10 CSI requirements This CR is only partially implemented due to confliction with CR 966	10.5.0
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 966	10.5.0
12-2011	RP-54	RP-111693	971r1	CR on Colliding CRS for non-MBSFN ABS	10.5.0
12-2011	RP-54	RP-111693	972r1	Introduction of eICIC demodulation performance requirements for FDD and TDD	10.5.0
12-2011	RP-54	RP-111686	985	Adding missing UL configuration specification in some UE receiver requirements for case of 1 CC UL capable UE	10.5.0
12-2011	RP-54	RP-111684	998	Correction and maintenance on CQI and PMI requirements (Rel- 10)	10.5.0
12-2011	RP-54	RP-111735	1004	MPR for CA Multi-cluster	10.5.0
12-2011	RP-54	RP-111691	1005	CA demodulation performance requirements for LTE FDD	10.5.0
12-2011	RP-54	RP-111692	1006	CQI reporting accuracy test on frequency non-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1007	CQI reporting accuracy test on frequency-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1008	PMI reporting accuracy test for TDD on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1009r1	CR for TS 36.101: RI performance requirements	10.5.0
12-2011	RP-54	RP-111692	1010r1	CR for TS 36.101: Introduction of static CQI tests (Rel-10)	10.5.0
03-2012	RP-55	RP-120291	1014	RF: Updates and corrections to the RMC-s related annexes (Rel- 10)	10.6.0
03-2012	RP-55	RP-120300	1015r1	On eICIC ABS pattern	10.6.0
03-2012	RP-55	RP-120300	1016r1	On eICIC interference models	10.6.0
03-2012	RP-55	RP-120299	1017r1	TS36.101 CR: on eDL-MIMO channel model using cross- polarized antennas	10.6.0
03-2012	RP-55	RP-120304	1020r1	TS36.101 CR: Correction to MBMS Performance Test Parameters	10.6.0
03-2012	RP-55	RP-120303	1021	Harmonic exceptions in LTE UE to UE co-ex tests	10.6.0
03-2012	RP-55	RP-120304	1023	Unified titles for Rel-10 CSI tests	10.6.0
03-2012	RP-55	RP-120300	1033r1	Introduction of reference channel for eICIC demodulation	10.6.0
03-2012	RP-55	RP-120304 RP-120304	1040r1	Correction of Actual code rate for CSI RMCs	10.6.0
03-2012 03-2012	RP-55 RP-55	RP-120304 RP-120296	1041r1 1048r1	Definition of synchronized operation Intra band contiguos CA Ue to Ue Co-ex	10.6.0 10.6.0
03-2012	RP-55	RP-120296	1049r1	REL-10 CA specification editorial consistency	10.6.0
03-2012	RP-55	RP-120299	1053	Beamforming model for TM9	10.6.0
03-2012	RP-55	RP-120296	1054	Requirement for CA demodulation with power imbalance	10.6.0
03-2012	RP-55	RP-120298	1057	Updating Band 23 duplex specifications	10.6.0
03-2012	RP-55	RP-120298	1058r1	Correcting UE Coexistence Requirements for Band 23	10.6.0
03-2012	RP-55	RP-120304	1059r1	CA demodulation performance requirements for LTE TDD	10.6.0
03-2012	RP-55	RP-120304	1061	Requirement for CA SDR FDD test scenario	10.6.0
03-2012	RP-55	RP-120293	1064r1	TS36.101 RF editorial corrections Rel 10	10.6.0
03-2012 03-2012	RP-55 RP-55	RP-120299 RP-120304	1067r1 1071r1	Introduction of TM9 demodulation performance requirements Introduction of a CA demodulation test for UE soft buffer	10.6.0 10.6.0
03-2012	RP-55	RP-120296	1072	MPR formula correction For intra-band contiguous CA	10.6.0
03-2012	RP-55	RP-120303	1077r1	Bandwidth Class C CR for 36.101: B41 REFSENS and MOP changes to	10.6.0
03-2012	RP-55	RP-120300	1082	accommodate single filter architecture TM3 tests for eICIC	10.6.0
03-2012	RP-55	RP-120300	1083r1	Introduction of requirements of CQI reporting definition for ecICIC	10.6.0
03-2012	RP-55	RP-120304	1084	eDL MIMO CSI requirements	10.6.0
03-2012	RP-55	RP-120306	1070r1	Introduction of Band 26/XXVI to TS 36.101	11.0.0
03-2012	RP-55	RP-120310	1074	Band 41 CA CR for TS36.101, section 5	11.0.0
03-2012	RP-55	RP-120310	1075r1	Band 41 CA CR for TS36.101, section 6	11.0.0
03-2012	RP-55	RP-120310	1076	Band 41 CA CR for TS36.101, section 7	11.0.0
06-2012	RP-56	RP-120795	1085r2	Modulator specification tightening	11.1.0
06-2012	RP-56	RP-120777	1087r1	Carrier aggregation Relative power tolerance, removal of TBD.	11.1.0
06-2012	RP-56	RP-120783	1089	UE spurious emissions for Band 7 and Band 38 coexistence	11.1.0
06-2012	RP-56	RP-120780	1092	Deleting square brackets in Reference Measurement Channels	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	11.1.0
				CR to TS36.101: Fixed reference channel for PDSCH demodulation performance requirements on eDL-MIMO – NOT	
06-2012	RP-56	RP-120780	1098r1	implemented as it is based on a wrong version of the spec	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 eICIC 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 elCIC 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
00.0010	DD 50	DD 400704	4474	requirements from Interband CA subclauses	44.4.2
06-2012	RP-56 RP-56	RP-120781	1174	PDCCH wrong detection in receiver spurious emissions test     Corrections to 3500 MHz	11.1.0
06-2012 06-2012	RP-56 RP-56	RP-120776 RP-120793	1184 1189r2	Introduction of Band 44	11.1.0 11.1.0
06-2012	RP-56 RP-56	RP-120793 RP-120784	1189f2 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	1199	Correction of wrong table refernces in CA receiver tests	11.1.0
06-2012	RP-56	RP-120791	1200r1	Introduction of e850_LB (Band 27) to TS 36.101	11.1.0
06-2012	RP-56	RP-120764	1212	Correction of PHS protection requirements for TS 36.101	11.1.0
06-2012	RP-56	RP-120793	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 on subclause 6.3.4A for TS36.101	11.1.0
06-2012	RP-56	RP-120795	1219r1	Aligning requirements between Band 18 and Band 26 in TS36.101	11.1.0
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 elCIC CQI test	11.1.0
09-2012	RP-57	RP-121294	1230	Correct Transport Block size in 9RB 16QAM Uplink Reference	11.2.0
				Measurement Channel	
09-2012	RP-57	RP-121313	1233r1	RF: Corrections to power allocation parameters for transmission	11.2.0
09-2012	DD 57	DD 101204	1005	mode 8 (Rel-11) RF-CA: non-CA notation and applicability of test points in	11.0.0
09-2012	RP-57	RP-121304	1235	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		14 121000	1207	demodulation requirements (Rel-11)	11.2.0
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
00.0040		DD 404000	1040	63AH-0204 for Rel-11)	11.0.0
09-2012	RP-57	RP-121302	1243	CR on eICIC CQI definition test (resubmission of R4-63AH-0205 for Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1245	Transmission of CQI feedback and other corrections (Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1243	Target SNR setting for eICIC MBSFN-ABS demodulation	11.2.0
				requirements (Rel-11)	
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-121300	1251	Corrections of spurious emission band UE co-existence	11.2.0
				applicable in Japan	
09-2012	RP-57	RP-121306	1253	Correction on RMC for frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1255	Requirements for the eDL-MIMO CQI test	11.2.0
09-2012 09-2012	RP-57 RP-57	RP-121302 RP-121316	1257 1258	Clarification on PDSCH test setup under MBSFN ABS Update of Band 28 requirements	11.2.0 11.2.0
09-2012	RP-57 RP-57	RP-121316 RP-121313	1258	Applicability of statement allowing RBW < Meas BW for spurious	11.2.0
09-2012	RP-57	RP-121313	1265	Clarification of RB allocation for DRS demodulation tests	11.2.0
09-2012	RP-57	RP-121304	1267	Removal of brackets for CA Tx	11.2.0
09-2012	RP-57	RP-121337	1268r1	TS 36.101 CR for CA_38	11.2.0
09-2012	RP-57	RP-121327	1269	Introduction of CA_B7_B20 in 36.101	11.2.0
09-2012	RP-57	RP-121313	1271	Corrections of FRC subframe allocations and other minor	11.2.0
				problems	
09-2012	RP-57	RP-121305	1274	Introduction of requirements for TDD CA Soft Buffer Limitation	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 27	11.2.0
09-2012	RP-57	RP-121215	1292r1	Introduction of CA band combination Band3 + Band5 to TS 36.101	11.2.0
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 09-2012	RP-57 RP-57	RP-121338 RP-121331	1324r2 1325	36.101 CR for LTE_CA_B7 Introduction of CA_3_20 RF requirements into TS36.101	11.2.0 11.2.0
09-2012	RP-57 RP-57	RP-121331 RP-121316	1325	A-MPR table correction for NS_18	11.2.0
09-2012	RP-57	RP-121310	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
09-2012	RP-57	RP-121302	1358	Introduction of RI test for eICIC	11.2.0
09-2012	RP-57	RP-121304	1360	Notes for deltaTib and deltaRib tables	11.2.0
09-2012	RP-57	RP-121304	1361	CR for A-MPR masks for NS_CA_1C	11.2.0
12-2012	RP-58	RP-121884	1362	Introduction of CA_3_8 RF requirements to TS 36.101	11.3.0
12-2012 12-2012	RP-58 RP-58	RP-121870 RP-121861	1363 1366	Removal of square brackets for Band 27 in Table 5.6.1-1           Some changes related to CA tests and overview table of DL	11.3.0 11.3.0
12-2012	RP-58	RP-121860	1000	measurement channels	11.2.0
12-2012	RP-58	RP-121860	1368 1370	Correction of eICIC CQI tests Correction of eICIC demodulation tests	11.3.0 11.3.0
12-2012	RP-56 RP-58	RP-121862	1370	Correction of CSI-RS subframe offset parameter	11.3.0
12-2012	RP-58	RP-121862	1376	Correction on FRC table in CSI test	11.3.0
12-2012	RP-58	RP-121862	1382	Correction of reference channel table for TDD eDL-MIMIO RI test	11.3.0
12-2012	RP-58	RP-121850	1386	OCNG patterns for Sustained Data rate testing	11.3.0
12-2012	RP-58	RP-121867	1388r1	Introduction of one periodic CQI test for CA deployments	11.3.0
12-2012	RP-58	RP-121894	1396	Introduction of CA_B5_B12 in 36.101	11.3.0
12-2012	RP-58	RP-121850	1401	Introducing the additional frequency bands of 5 MHz x 2 in 1.7 GHz in Japan to Band 3	11.3.0
12-2012	RP-58	RP-121887	1406r1	Reference sensitivity for the small bandwidth of CA_4-12	11.3.0
12-2012	RP-58	RP-121860	1407	CR on elCIC RI test	11.3.0
12-2012	RP-58	RP-121862	1409	Cleaning of 36.101 Performance sections Rel-11	11.3.0
12-2012	RP-58	RP-121861	1416	Out-of-band blocking requirements for inter-band carrier aggregation	11.3.0
12-2012	RP-58	RP-121861	1418	Adding missed SNR reference values for CA soft buffer tests	11.3.0
12-2012	RP-58	RP-121890	1422	Introduction of CA_4A-5A into 36.101	11.3.0
12-2012	RP-58	RP-121867	1431	Clean up of specification R11 Band 1 to Band 33 and Band 39 UE coexistence requirements	11.3.0
12-2012 12-2012	RP-58 RP-58	RP-121867 RP-121871	1436 1437r1	Editorial corrections for Band 26	11.3.0 11.3.0
12-2012	RP-58 RP-58	RP-121871 RP-121896	14371	Introduction of Band 5 + Band 17 inter-band CA configuration into 36.101	11.3.0
12-2012	RP-58	RP-121862	1442	Correction of eDL-MIMO RI test and RMC table for the CSI test	11.3.0
12-2012	RP-58	RP-121861	1442	Minor correction to ceiling function example - rel11	11.3.0
12-2012	RP-58	RP-121862	1449	Correction of SNR definition	11.3.0
12-2012	RP-58	RP-121860	1450	Brackets clean up for eICIC CSI/demodulation	11.3.0
12-2012	RP-58	RP-121860	1455	CR on elCIC RI testing (Rel-11)	11.3.0
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12-2012 12-2012 12-2012	RP-58 RP-58	RP-121862 RP-121879	1459	Correction on FRC table CR for LTE B14 HPUE (Power Class 1)	11.3.0

12-2012	RP-58	RP-121862	1464	Adding references to the appropriate beamforming model (Rel-	11.3.0
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12-2012 12-2012	RP-58 RP-58	RP-121898 RP-121882	1465r1 1468r1	Introduction of CA_8_20 RF requirements into TS36.101 Introduction of inter-band CA_11-18 into TS36.101	11.3.0 11.3.0
12-2012	RP-58	RP-121882 RP-121903	140011 1472r1	Introduction of inter-band CA_11-18 into 1536.101	11.3.0
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12-2012	RP-58	RP-121903	1473r1	Introduction of performance requirements for verifying the receiver type for advanced receivers (FDD/TDD)	11.3.0
12-2012	RP-58	RP-121886	1474	CR to remove the square bracket of A-MPR in TS36.101	11.3.0
12-2012	RP-58	RP-121861	1476	Correction of some errors in reference sensitivity for CA in TS	11.3.0
12-2012	RP-58	RP-121903	1480r1	36.101 (R11) Introduction of Advanced Receivers Test Cases for TDD	11.3.0
12-2012	RP-58	RP-121901	1490r1	Introduction of Band 29	11.3.0
12-2012	RP-58	RP-121849	1494	Low-channel Band 1 coexistence with PHS	11.3.0
12-2012	RP-58	RP-121861	1498r1	Completion of the tables of bandwidth combinations specified for CA	11.3.0
12-2012	RP-58	RP-121861	1499r1	Exceptions to REFSENS requirements for class A2 CA combinations	11.3.0
12-2012	RP-58	RP-121892	1500	Introduction of carrier aggregation configuration CA_4-7	11.3.0
12-2012	RP-58	RP-121870	1504	Editorial corrections to Band 27 specifications	11.3.0
12-2012	RP-58	RP-121878	1505	Band 28 AMPR for DTV protection	11.3.0
12-2012	RP-58	RP-121852	1509r1	UE-UE coexistence between bands with small frequency separation	11.3.0
12-2012	RP-58	RP-121911	1510	Adding UE-UE Coexistence Requirement for Band 3 and Band	11.3.0
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12-2012 12-2012	RP-58 RP-58	RP-121866 RP-121851	1513 1515	Maintenance of Band 23 UE Coexistence Corrections to TM4 rank indicator Test 3	11.3.0 11.3.0
12-2012	RP-56	RP-121861	1515	Correction of test configuraitons and FRC for CA demodulation	11.3.0
12-2012	RP-58	RP-121860	1518	with power imbalance           Applicable OFDM symbols of Noc_2 for PDCCH/PCFICH ABS-	11.3.0
03-2013	RP-59	RP-130279	1519	MBSFN test cases OCNG patterns for Enhanced Performance Requirements Type	11.4.0
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03-2013	RP-59	RP-130268	1523	Brackets removal in Rel-11 TM4 rank indicator Test 3	11.4.0
03-2013	RP-59	RP-130279	1524r1	Cleanup of Advanced Receivers requirement scenarios for	11.4.0
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03-2013	RP-59	RP-130264	1539	Correction of CA power imbalance performance requirements	11.4.0
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03-2013	RP-59	RP-130287	1544r1	36.101(R11) Correction of some inter-band CA requiements for TS 36.101 (R11)	11.4.0
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03-2013	RP-59	RP-130263	1557	CA_1C: CA_NS_02 and CA_NS_03 A-MPR REL-11	11.4.0
03-2013	RP-59	RP-130287	1560	Editorial corrections to subclause 5	11.4.0
)3-2013	RP-59	RP-130267	1562	Addition of UE Regional Requirements to Band 23 Based on New Regulatory Order in the US	11.4.0
03-2013	RP-59	RP-130272	1567	Band 26: modification of A-MPR for 'NS_15'	11.4.0
03-2013	RP-59	RP-130287	1571r1	Band 41 requirements for operation in China and Japan	11.4.0
03-2013	RP-59	RP-130260	1574	Remove [] from CSI test case parameters	11.4.0
03-2013	RP-59	RP-130287	1575	Corrections to UE co-existence	11.4.0
03-2013	RP-59	RP-130287	1579 1580	UE-UE co-existence between Band 1 and Band 33/39	11.4.0
03-2013	RP-59 RP-59	RP-130287		Correction on reference to note for Band 7 and 38 co-existence	11.4.0
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03-2013 03-2013	RP-59 RP-59	RP-130264 RP-130287	1597 1600r1	Correction of CA CQI test setup Correction of B12 DL Specification in Table 5.5A-2	11.4.0
03-2013 03-2013	RP-59 RP-59	RP-130263	1602	Correction of table reference	11.4.0
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06-2013	RP-60	RP-130770	1613	CR for 36.101 : Adding the definition of CA_NS_05 and CA_NS_06 for additional spurious emissions for CA	11.5.0
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06-2013	RP-60	RP-130765	1623	Correction of test parameters for elCIC performance requirements	11.5.0
06-2013	RP-60	RP-130765	1625	Correction of test parameters for eICIC CSI requirements	11.5.0
06-2013	RP-60	RP-130765	1627	Correction of resource allocation for the multiple PMI Cat 1 UE test	11.5.0
06-2013	RP-60	RP-130766	1629	Removal of note 2 from band 28	11.5.0
06-2013	RP-60	RP-130770	1641	Correction of the CSI-RS parameter configuration	11.5.0
06-2013	RP-60	RP-130770	1650r1	Addition of Band 41 for intra-band non-contiguous CA for 36.101	11.5.0
06-2013	RP-60	RP-130770	1654r1	MPR for intra-band non-contiguous CA	11.5.0
06-2013	RP-60	RP-130765	1656	Modification of configured output power to account for larger tolerance	11.5.0
06-2013	RP-60	RP-130769	1658r1	Missing symbols in the NS_15 table	11.5.0
06-2013	RP-60	RP-130766	1673	Corrections to Rx requirements for inter-band CA configurations with REFSENS exceptions	11.5.0
06-2013	RP-60	RP-130770	1681r1	Correction for TS 36.101	11.5.0
06-2013	RP-60	RP-130763	1684	RF: Corrections to RMC-s for sustained data rate test	11.5.0
06-2013	RP-60	RP-130770	1685	Non-contiguous intraband CA channel spacing	11.5.0
06-2013	RP-60	RP-130766	1689	Carrier aggregation in multi RAT and multiple band combination terminals	11.5.0
06-2013	RP-60	RP-130766	1691	Completion of out-of-band blocking requirements for inter-band CA with one UL	11.5.0
06-2013	RP-60	RP-130767	1695r1	CR on the bandwidth coverage issue of CA demodulation performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130765	1697	Correction on UE maximum output power for intra-band CA (R11)	11.5.0
06-2013	RP-60	RP-130770	1698r1	CR for introduction of FeICIC demodulation performance requirements	11.5.0
06-2013	RP-60	RP-130770	1701	Removing bracket from CA_11A-18A requirments	11.5.0
06-2013	RP-60	RP-130767	1703	CR on the bandwidth coverage issue of CA CQI performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130766	1705	Corrections to ACLR for Rel-11 CA	11.5.0
06-2013	RP-60	RP-130765	1716	Corrections to NS_11 A-MPR Table	11.5.0
06-2013	RP-60	RP-130769	1717	Corrections to NS_12 A-MPR Table	11.5.0
09-2013	RP-61	RP-131285	1731r1	CR on performance requirements of CA soft buffer managemen (Rel-11)	11.6.0
09-2013	RP-61	RP-131281	1735	CR on applicability of CA sustained data rate tests (Rel-11)	11.6.0
09-2013	RP-61	RP-131293	1738r1	Performance requirement for UE under EVA200	11.6.0
09-2013 09-2013	RP-61 RP-61	RP-131290	1742r1 1744r1	CR for introduction of FeICIC PBCH performance requirement CR for introduction of FeICIC RI reporting requirements	11.6.0
09-2013	RP-61	RP-131290 RP-131292	174411	Beamforming model for EPDCCH test	11.6.0 11.6.0
09-2013	RP-61	RP-131285	1753r1	Introduction of performance requirements for verifying the	11.6.0
09-2013	RP-61	RP-131285	1754r1	receiver type for CSI-RS based advanced receivers (FDD/TDD) CR for 36.101 : Add the definition of 5+20MHz for spectrum	11.6.0
09-2013	RP-61	RP-131281	1766	emission mask for CA UE REFSENS when supporting intra-band CA and inter-band	11.6.0
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09-2013	RP-61	RP-131279	1771	Correlation matrix for high speed train demodulation scenarios (Rel-11)	11.6.0
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09-2013	RP-61	RP-131293	1795 1799r1	CA UE Coexistence Table update (Release 11)	11.6.0
09-2013	RP-61	RP-131302	1801	Coexistence between Band 27 and Band 38 (Release 11)	11.6.0
09-2013	RP-61	RP-131281	1806	Incorrect REFSENS UL allocation for CA_1C	11.6.0
09-2013	RP-61	RP-131281	1810	Contiguous intraband CA REFSENS with one UL	11.6.0
09-2013	RP-61	RP-131293	1812r1	Remianed Transmitter requirements for intra-band non- contiguous CA	11.6.0
09-2013	RP-61	RP-131281	1816	Correction to Rel-11 A-MPR for CA_NS_04	11.6.0
09-2013	RP-61	RP-131281	1820	The Pcmax clauses restructured	11.6.0
09-2013	RP-61	RP-131285	1830	MPR for intra-band non-contiguous CA	11.6.0
12-2013	RP-62	RP-131928	1846r1	Corrections to the notes in the band UE co-existence requirements table (Rel-11)	11.7.0
12-2013	RP-62	RP-131924	1851	Clean-up of uplink reference measurement channels (Rel-11)	11.7.0
12-2013	RP-62	RP-131937	1853r2	Introduction of test 1-A for CoMP	11.7.0
12-2013	RP-62	RP-131931 RP-131939	1866	CA_NS_05 Emissions	11.7.0 11.7.0
12-2013	RP-62 RP-62	RP-131939 RP-131928	1868 1876r2	NS signaling for CA refsens Intraband CA channel bandwidth combination table restructuring	11.7.0
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12-2013	RP-62	RP-131939	1886	CR on correction of definition on Fraction of Maximum	11.7.0
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12-2013	RP-62	RP-131939	1888	CR on correction of test configurations of CA soft buffer tests	11.7.0
12-2013	RP-62	RP-131936	1892r1	CR for FelCIC demodulation performance requirements	11.7.0
12-2013	RP-62	RP-131936	1894r3	CR on FeICIC PBCH performance requirement	11.7.0
12-2013	RP-62	RP-131936	1896r3	CR on RI reporting requirement	11.7.0
12-2013	RP-62	RP-131938	1898	Beamforming model for EPDCCH localized test	11.7.0
12-2013	RP-62	RP-131938	1900	Downlink physical setup for EPDCCH test	11.7.0
12-2013	RP-62	RP-131926	1903	Correction on the UE category for elCIC CQI test	11.7.0
12-2013	RP-62	RP-131931	1905	CR for receiver type verification test of CSI-RS based advanced receivers (Rel-11)	11.7.0
12-2013	RP-62	RP-131928	1915r2	Allowed power reductions for multiple transmissions in a subframe	11.7.0
12-2013	RP-62	RP-131936	1925r2	Introduce high SNR TM3 test for FeICIC PDSCH	11.7.0
12-2013	RP-62	RP-131927	1933r1	CR on correction of FRC of power imbalance test	11.7.0
12-2013	RP-62	RP-131927	1936	UE-UE coexistence for Band 40	11.7.0
12-2013	RP-62	RP-131937	1939r2	CR to Introduce fading CQI test for CoMP (FDD)	11.7.0
12-2013	RP-62	RP-131927	1944	CR Removing Addition of ΔTc to P-MPR	11.7.0
12-2013	RP-62	RP-131937	1954r2	CR Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)	11.7.0
12-2013	RP-62	RP-131931	1960	CA performance requirements for TDD intra-band NC CA	11.7.0
12-2013	RP-62	RP-131936	1961r1	Introduction of reference SNR-s for FeICIC demodulation performance requirements	11.7.0
12-2013	RP-62	RP-131938	1963	OCNG pattern for EPDCCH test	11.7.0
12-2013	RP-62	RP-131939	1967r1	Introduction of UE TM3 demodulation performance requirements under ETU300	11.7.0
12-2013	RP-62	RP-131937	1969r1	Introduction of test 1-A for CoMP TDD	11.7.0
12-2013	RP-62	RP-131939	1971	Modification of TM9 test to verify correct SNR estimation	11.7.0
12-2013	RP-62	RP-131928	1983r1	Correction to blocking requirements and use of $\Delta R_{IB}$	11.7.0
12-2013	RP-62	RP-131939	1987r1	CR on test point clarification for CA demodulation test	11.7.0
12-2013	RP-62	RP-131937	1993r1	CR to Introduce fading CQI test for CoMP (TDD)	11.7.0
12-2013	RP-62	RP-131937	1995	CR to Introduce channel model for CoMP fading CQI tests	11.7.0
12-2013	RP-62	RP-131937	1997r1	CR to Introduce RI test for CoMP (FDD)	11.7.0
12-2013	RP-62	RP-131924	1999r1	Simplification of Band 12/17 in-band blocking test cases	11.7.0
12-2013	RP-62	RP-131938	2000r1	Distributed EPDCCH Demodulation Test	11.7.0
12-2013	RP-62	RP-131938	2002r1	Localized EPDCCH Demodulation Test	11.7.0
12-2013	RP-62	RP-131938	2004r1	Reference Measurement Channels for EPDCCH	11.7.0
12-2013 12-2013	RP-62 RP-62	RP-131937	2006r1 2008r1	Introduction of DL CoMP FDD static CQI test Introduction of DL CoMP TDD static CQI test	11.7.0 11.7.0
12-2013	RP-62 RP-62	RP-131937 RP-131924	200811	P-max for Band 38 to Band 7 coexistence	11.7.0
12-2013	RP-62	RP-131924 RP-131937	2013 2023r2	Minimum requirement with Same Cell ID (with multiple NZP CSI- RS resources) TDD	11.7.0
12-2013	RP-62	RP-131937	2025r2	CR Minimum requirement with Different Cell ID and Colliding	11.7.0
12-2013	RP-62	RP-131936	2027	CRS (with single NZP CSI-RS resource) TDD Editoral change on FeICIC PBCH Noc setup	11.7.0
12-2013	RP-62	RP-131930	2027 2034r1	Correction of nominal guard bands for bandwidth classes A and	11.7.0
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12-2013	RP-62 RP-62	RP-131937	2041r1 2044	CR to Introduce RI test for CoMP (TDD) Correction of TDD PCFICH/PDCCH test parameter table	11.7.0 11.7.0
12-2013 12-2013	RP-62 RP-62	RP-131931 RP-131939	2044	Add EVA200 to table of channel model parameters	11.7.0
12-2013	RP-62	RP-131939	2040	CA_1C: Correction on CA_NS_02 A-MPR table	11.7.0
12-2013	RP-62	RP-131920	2058	Introduction of EPDCCH TM10 localized test R-11	11.7.0
12-2013	RP-62	RP-131938	2003	Introduction of SDR test for PDSCH with EPDCCH scheduling	11.7.0
03-2014	RP-63	RP-140368	2007 2091r1	CR for maintanence of CA soft buffer tests in Rel-11	11.8.0
03-2014	RP-63	RP-140300	2096r1	CR on TM9 localized ePDCCH test	11.8.0
03-2014	RP-63	RP-140374	2100r1	CR on reference measurement channel for ePDCCH test	11.8.0
03-2014	RP-63	RP-140371	2105	Cleanup of the specification for FelCIC (Rel-11)	11.8.0
03-2014	RP-63	RP-140371	2107r1	UL-DL configuration and other parameters for FeICIC TDD CQI fading test (Rel-11)	11.8.0
03-2014	RP-63	RP-140375	2088	CR for introduction of 15MHz based SDR tests in Rel-11	11.8.0
03-2014	RP-63	RP-140371	2109r1	CR for TS36.101 COMP demodulation requirements	11.8.0
03-2014	RP-63	RP-140371	2111r1	CR for Combinations of channel model parameters	11.8.0
03-2014	RP-63	RP-140374	2112	CR for EPDCCH power allocation (Rel-11)	11.8.0
03-2014	RP-63	RP-140371	2085	CR on reference measurement channel for TM10 PDSCH demodulation test	11.8.0
03-2014	RP-63	RP-140374	2073r1	CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-11)	11.8.0
03-2014	RP-63	RP-140368	2146	Correction of coding rate for 18RBs in UL RMC table	11.8.0
03-2014	RP-63	RP-140371	2130r1	CR to finalize RI test for CoMP	11.8.0
03-2014	RP-63	RP-140374	2162r1	Distributed EPDCCH Demodulation Test	11.8.0
03-2014	RP-63	RP-140371	2128r1	CR to finalize fading CQI test for CoMP	11.8.0
03-2014	RP-63	RP-140370	2159r1	Correction of table notes for NS_12-NS_15 spurious emissions	11.8.0
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	RP-63	RP-140368	2136	Configured transmitted power for CA	11.8.0
03-2014	RP-63	RP-140300	2130 2143r1	Channel spacing for non-contiguous intra-band carrier	11.8.0
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03-2014	RP-63	RP-140371	2141	Clarification of contiguous and non-contiguous intra-band UE capabilities in the same band	11.8.0
03-2014	RP-63	RP-140368	2158	Correction of a table note for Pcmax	11.8.0
03-2014	RP-63	RP-140368	2121	CR for 36.101. Editorial correction on OCNG pattern	11.8.0
03-2014	RP-63	RP-140374	2124r1	CR on correction of downlink SDR tests with EPDCCH scheduling	11.8.0
03-2014	RP-63	RP-140375	2118	Introduction of requirements for SNR test for TM9	11.8.0
03-2014	RP-63	RP-140371	2126r2	Correction on DL CoMP static CQI tests (Rel 11)	11.8.0
06-2014	RP-64	RP-140909	2176r2	RF: Corrections to spurious emission requirements with NS different than NS_01 (Rel-11)	11.9.0
06-2014	RP-64	RP-140914	2197r1	CR on correction on TDD IRC CQI test	11.9.0
06-2014	RP-64	RP-140917	2206r1	CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-11): correction of CSI-RS configurations	11.9.0
06-2014	RP-64	RP-140918	2208	Clean up of TM9 SNR tests	11.9.0
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
06-2014	RP-64	RP-140911	2217r1	CR of modification on FeICIC rank testing (Rel-11)	11.9.0
06-2014	RP-64	RP-140914	2219r1	CR on FeICIC PBCH performance requirement (Rel-11)	11.9.0
06-2014	RP-64	RP-140918	2221r1	Correction on out-of-band blocking for CA	11.9.0
06-2014	RP-64	RP-140918	2225	Update demodualtion performance requirements with new UE categories	11.9.0
06-2014	RP-64	RP-140911	2227r1	Correction for CA sustained data rate test (Rel-11)	11.9.0
06-2014	RP-64	RP-140918	2230r1	CR on OCNG and propagation conditions for dual layer TM9 test	11.9.0
06-2014	RP-64	RP-140911	2232	Clarification of Intra-band contiguous CA class C Narrow band blocking requirements	11.9.0
06-2014	RP-64	RP-140911	2238	Correction for CA soft buffer test (Rel-11)	11.9.0
06-2014	RP-64	RP-140911	2246r1	Remove [] from eICIC TDD RI requirement	11.9.0
06-2014	RP-64	RP-140914	2255	Verification of exceptions of REFSENS requirements for carrier aggregation	11.9.0
06-2014	RP-64	RP-140914	2257	Applicability of exceptions to reference sensitivity requirements for CA	11.9.0
06-2014	RP-64	RP-140918	2261r1	Editorial corrections for UE performance requirments for R11	11.9.0
06-2014	RP-64	RP-140909	2268	In-band blocking case nubering re-establisment	11.9.0
06-2014	RP-64	RP-140918	2272	CR for TS36.101 FRC tables for COMP demodulation requirements	11.9.0
06-2014	RP-64	RP-140911	2281r1	Finalization of CoMP demodulation test cases	11.9.0
06-2014	RP-64	RP-140914	2285	CR for finalizing DL COMP CSI reporting requirements	11.9.0
06-2014	RP-64	RP-140914	2287r1	CR for adding DL CoMP CSI RMC tables (Rel-11)	11.9.0
06-2014	RP-64	RP-140911	2313	UE to UE co-existence between B42/B43	11.9.0
06-2014	RP-64	RP-140911	2317	Perf: Corrections to CA (Class C) performance with power imbalance (Rel-11)	11.9.0
06-2014	RP-64	RP-140914	2320r1	CR of modification on FelCIC rank testing (Rel-11)	11.9.0
06-2014	RP-64	RP-140914	2322r1	CR of introducing FelCIC TM9 testing (Rel-11)	11.9.0
06-2014	RP-64	RP-140917	2324r1	CR for EPDCCH SDR test (Rel-11)	11.9.0
06-2014	RP-64	RP-140911	2327	Clean-up CR for demodulation requirements (Rel-11)	11.9.0
06-2014	RP-64	RP-140911	2332	Throughput calculation for eICIC demodulation requirements	11.9.0
06-2014	RP-64	RP-140914	2334r1	Introduction of Band 28 requirements for flexible operation in Japan Add missing Uplink downlink configuration to eICIC TDD RI	11.9.0
	RP-64	RP-140911	2336r1	requirement	11.9.0
06-2014	DD 64	DD 140044	2240	Cleanup of terminology for Dy requirements	11.0.0
06-2014	RP-64	RP-140911	2340	Cleanup of terminology for Rx requirements	11.9.0
06-2014 06-2014	RP-64	RP-140918	2343	Cleanup of terminology for Rx requirements CR on separating CA UE demodulation tests from single carrier tests in Rel-11	11.9.0
06-2014 06-2014 06-2014	RP-64 RP-64	RP-140918 RP-140911	2343 2350	Cleanup of terminology for Rx requirements CR on separating CA UE demodulation tests from single carrier tests in Rel-11 Test configuration for intra-band contiguous carrier aggregation power control	11.9.0 11.9.0
06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64	RP-140918 RP-140911 RP-140914	2343 2350 2361r1	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation	11.9.0 11.9.0 11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014	RP-64 RP-64 RP-64 RP-64	RP-140918 RP-140911 RP-140914 RP-140911	2343 2350 2361r1 2364	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation           Clarification on CA bandwidth classes	11.9.0 11.9.0 11.9.0 11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140911           RP-140917	2343       2350       2361r1       2364       2373	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation           Clarification on CA bandwidth classes           CR on correction of downlink SDR tests with EPDCCH scheduling	11.9.0 11.9.0 11.9.0 <u>11.9.0</u> 11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140911           RP-140917           RP-140911	2343       2350       2361r1       2364       2373       2376	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation           Clarification on CA bandwidth classes           CR on correction of downlink SDR tests with EPDCCH scheduling           Corrections on CA CQI tests	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140911           RP-140917           RP-140911           RP-140911	2343 2350 2361r1 2364 2373 2376 2386r1	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation           Clarification on CA bandwidth classes           CR on correction of downlink SDR tests with EPDCCH scheduling           Corrections on CA CQI tests           CR on PDSCH transmission for eICIC CSI requirements (Rel-11)	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140911           RP-140917           RP-140911           RP-140911           RP-140911           RP-140911           RP-140911	2343       2350       2361r1       2364       2373       2376       2386r1       2390	Cleanup of terminology for Rx requirements           CR on separating CA UE demodulation tests from single carrier tests in Rel-11           Test configuration for intra-band contiguous carrier aggregation power control           Correction of test configurations for intra-band non-contiguous aggregation           Clarification on CA bandwidth classes           CR on correction of downlink SDR tests with EPDCCH scheduling           Corrections on CA CQI tests           CR on PDSCH transmission for eICIC CSI requirements (Rel-11)           CA_7C A-MPR Corrections	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140911           RP-140917           RP-140911           RP-140911           RP-140911           RP-140911           RP-140913	2343         2350         2361r1         2364         2373         2376         2386r1         2390         2393	Cleanup of terminology for Rx requirements         CR on separating CA UE demodulation tests from single carrier tests in Rel-11         Test configuration for intra-band contiguous carrier aggregation power control         Correction of test configurations for intra-band non-contiguous aggregation         Clarification on CA bandwidth classes         CR on correction of downlink SDR tests with EPDCCH scheduling         Corrections on CA CQI tests         CR on PDSCH transmission for eICIC CSI requirements (Rel-11)         CA_7C A-MPR Corrections         CR for TS36.101 CSI RMC table	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140917           RP-140917           RP-140911           RP-140911           RP-140913           RP-140914           RP-140914	2343         2350         2361r1         2364         2373         2376         2386r1         2390         2393         2424	Cleanup of terminology for Rx requirements         CR on separating CA UE demodulation tests from single carrier tests in Rel-11         Test configuration for intra-band contiguous carrier aggregation power control         Correction of test configurations for intra-band non-contiguous aggregation         Clarification on CA bandwidth classes         CR on correction of downlink SDR tests with EPDCCH scheduling         Corrections on CA CQI tests         CR on PDSCH transmission for eICIC CSI requirements (Rel-11)         CA_7C A-MPR Corrections         CR for TS36.101 CSI RMC table         CR on correction for TM10 CSI reporting requirements	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           09-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140917           RP-140917           RP-140911           RP-140911           RP-140911           RP-140911           RP-140911           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914	2343         2350         2361r1         2364         2373         2376         2386r1         2390         2393         2424         2503	Cleanup of terminology for Rx requirements         CR on separating CA UE demodulation tests from single carrier tests in Rel-11         Test configuration for intra-band contiguous carrier aggregation power control         Correction of test configurations for intra-band non-contiguous aggregation         Clarification on CA bandwidth classes         CR on correction of downlink SDR tests with EPDCCH scheduling         Corrections on CA CQI tests         CR on PDSCH transmission for elCIC CSI requirements (Rel-11)         CA_7C A-MPR Corrections         CR for TS36.101 CSI RMC table         CR on correction for TM10 CSI reporting requirements         Perf: Cleanup and better description of DL-RMC-s with dynamic coding rate for CSI requirements (Rel-11)	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0
06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 06-2014 09-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-65	RP-140918           RP-140911           RP-140914           RP-140917           RP-140917           RP-140911           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914           RP-140514           RP-140514           RP-140514           RP-140525           RP-141525	2343         2350         2361r1         2364         2373         2376         2386r1         2390         2393         2424         2503         2564	Cleanup of terminology for Rx requirements         CR on separating CA UE demodulation tests from single carrier tests in Rel-11         Test configuration for intra-band contiguous carrier aggregation power control         Correction of test configurations for intra-band non-contiguous aggregation         Clarification on CA bandwidth classes         CR on correction of downlink SDR tests with EPDCCH scheduling         Corrections on CA CQI tests         CR on PDSCH transmission for elCIC CSI requirements (Rel-11)         CA_7C A-MPR Corrections         CR for TS36.101 CSI RMC table         CR on correction for TM10 CSI reporting requirements         Perf: Cleanup and better description of DL-RMC-s with dynamic coding rate for CSI requirements (Rel-11)         Corrections to UE coex table	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.10.0
06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           06-2014           09-2014	RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64           RP-64	RP-140918           RP-140911           RP-140914           RP-140917           RP-140917           RP-140911           RP-140911           RP-140911           RP-140911           RP-140911           RP-140914           RP-140914           RP-140914           RP-140914           RP-140914	2343         2350         2361r1         2364         2373         2376         2386r1         2390         2393         2424         2503	Cleanup of terminology for Rx requirements         CR on separating CA UE demodulation tests from single carrier tests in Rel-11         Test configuration for intra-band contiguous carrier aggregation power control         Correction of test configurations for intra-band non-contiguous aggregation         Clarification on CA bandwidth classes         CR on correction of downlink SDR tests with EPDCCH scheduling         Corrections on CA CQI tests         CR on PDSCH transmission for elCIC CSI requirements (Rel-11)         CA_7C A-MPR Corrections         CR for TS36.101 CSI RMC table         CR on correction for TM10 CSI reporting requirements         Perf: Cleanup and better description of DL-RMC-s with dynamic coding rate for CSI requirements (Rel-11)	11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0         11.9.0

09-2014	RP-65	RP-141527	2483	Corrections on delta Tc for UE MOP for intra-band contiguous CA	11.10.0
09-2014	RP-65	RP-141527	2486	Removal of Class B in UE TX requirement	11.10.0
09-2014	RP-65	RP-141527	2515r1	CR for CA applicability rule in 36.101 in Rel-11	11.10.0
09-2014	RP-65	RP-141527	2518	Editorial CR for CA performance tests in 36.101 in Rel-11	11.10.0
09-2014	RP-65	RP-141527	2547	Correction to NS_20 A-MPR for Band 23	11.10.0
09-2014	RP-65	RP-141530	2446r1	CR of introducing FeICIC TM9 testing (Rel-11)	11.10.0
09-2014	RP-65	RP-141530	2453	Maintenance of CoMP demodulation performance requirements (Rel-11)	11.10.0
09-2014	RP-65	RP-141530	2455	Clean-up CR for EPDCCH and FeICIC PBCH (Rel-11)	11.10.0
09-2014	RP-65	RP-141530	2470	Throughput calculation for feICIC demodulation requirements	11.10.0
09-2014	RP-65	RP-141532	2438	CR on correction on CQI reporting TDD CSI meas in case two	11.10.0
09-2014	RP-65	RP-141532	2440	CSI subframe sets with CRS test (Rel-11) CR on correction on RI reporting CSI meas in case two CSI	11.10.0
00 2014	111 00	141002	2440	subframe sets with CRS tests (Rel-11)	11.10.0
09-2014	RP-65	RP-141532	2443	Clarification of high speed train scenario in 36.101 (Rel-11)	11.10.0
09-2014	RP-65	RP-141532	2472r1	Max input for Intra-band non-contiguous CA	11.10.0
09-2014	RP-65	RP-141532	2477	CQI reporting under fading: CQI indices in set	11.10.0
09-2014	RP-65	RP-141532	2489	Correction on A-MPR table	11.10.0
09-2014	RP-65	RP-141532	2498	RF: Corrections to spurious emission band co-existence requirement for Band 44	11.10.0
09-2014	RP-65	RP-141532	2521	CR on CA power imbalance tests in Rel-11	11.10.0
12-2014	RP-66	RP-142144	2573	CR for REFSENSE in lower SNR and change history	11.11.0
12-2014	RP-66	RP-142142	2586	CR for 1 PRB allocation performance in presence of MBSFN	11.11.0
-				(rel-11)	-
12-2014	RP-66	RP-142144	2589	Maintenance of CA demodulation performance requirements (Rel-11)	11.11.0
12-2014	RP-66	RP-142147	2591	Clean up for FelCIC demodulation performance requirements (Rel-11)	11.11.0
12-2014	RP-66	RP-142147	2628	CR to fix error of CA capability for CA performance tests in 36.101 in Rel-11	11.11.0
12-2014	RP-66	RP-142147	2633	Editorial CR for UL configuration table for intra-band contiguous and non-contiguous CA in 36.101, Rel-11	11.11.0
12-2014	RP-66	RP-142144	2636	Definition of the bits in the bitmap for indication of modified MPR	11.11.0
12-2014	RP-66	RP-142147	2660	behavior Maintenance of TM10 demodulation test configurations on PQI	11.11.0
				set and ZP-CSIRS ( Rel-11 test 8.3.1.3.2, 8.3.2.4.2 )	
12-2014	RP-66	RP-142149	2608r1	Correction on UE TM3 demodulation performance requirements	11.11.0
12-2014	RP-66	RP-142147	2619r1	CQI reporting in AWGN: CQI indices in set	11.11.0
12-2014	RP-66	RP-142147	2670r1	Correction of CoMP TDD CSI tests (Rel-11)	11.11.0
12-2014	RP-66	RP-142147	2640r1	Applicability of in-gap and out-of-gap measurements for intra- band NC CA	11.11.0
12-2014	RP-66	RP-142144	2699	Delete the incorrect notes for FDD DMRS demodulation tests (Rel-11)	11.11.0
12-2014	RP-66	RP-142144	2719	Band 22 correction in UE to UE co-existance table.	11.11.0
12-2014	RP-66	RP-142148	2707r1	Introduction of minimum requirements for intra-band NC CA with	11.11.0
12-2014	RP-66	RP-142144	2726r1	timing offset	11.11.0
12-2014 12-2014	RP-66	RP-142144 RP-142149	2675r1	CR for CA applicability rule in 36.101 in Rel-11 CR to remove CA capability column in CA performance test	11.11.0
				tables (Rel-11)	
12-2014	RP-66	RP-142149	2677r1	CR to specify applicability of CoMP RI test (Rel-11)	11.11.0
12-2014	RP-66	RP-142147	2746r1	TS36.101 removal of brackets (RF)	11.11.0
12-2014	RP-66	RP-142144	2754	Correction to Transmit Modulation Quality for CA	11.11.0
12-2014	RP-66	RP-142144	2709r1	Clarification of UL and DL CA configuration	11.11.0
12-2014	RP-66	RP-142144	2716r1	Clarification of notes relating to interferer offsets in intraband CA receiver requirement tables.	11.11.0
12 2014	DD 66	DD 440447	2724r1		11 11 0
12-2014 12-2014	RP-66 RP-66	RP-142147 RP-142144	2734r1 2757	Band 28 and NS_24 Correction to Note 2 of Harmonic Signal Exceptions in Spurious	11.11.0 11.11.0
12-2014	RP-66	RP-142144	2750r1	Emissions Removal of brackets and TBD from CA feature	11.11.0
12-2014	RP-66	RP-142144	2687r1	Removal of bracket for UL MIMO	11.11.0
12-2014	RP-66	RP-142144	2696r1	Maintenance of CA performance requirements (Rel-11)	11.11.0
12-2014	RP-66	RP-142144	2703r2	UE to UE co-existence between B42/B43	11.11.0
03-2015	RP-67	RP-150384	2763	Correction for timing offset test for intraband non-contiguous CA	11.12.0
03-2015	RP-67	RP-150384	2778	Modification of CSI reference measurement channel Rel-11	11.12.0
03-2015	RP-67	RP-150384	2782	Editorial correction on symbols for enhanced performance requirements type A	11.12.0
03-2015	RP-67	RP-150384	2796	UL HARQ in PDSCH and PDCCH/PCFICH demod test cases for	11.12.0
00.0015		DD 450000		elCIC/felCIC with MBSFN ABS	44.40.0
	RP-67	RP-150382	2799	Correction to eICIC aggressor cell configurations	11.12.0
		RP-150382	2804	Removal of eDL-MIMO term from specification	11.12.0
03-2015	RP-67				
03-2015	RP-67 RP-67	RP-150382	2818	UE to UE co-existence between B42/B43	11.12.0
03-2015 03-2015 03-2015 03-2015					11.12.0 11.12.0

03-2015	RP-67	RP-150382	2832	Corrections to the CA power imbalance test	11.12.0
03-2015	RP-67	RP-150392	2841	Editorial CR for CA UE performance tests in 36.101 in Rel-11	11.12.0
03-2015	RP-67	RP-150384	2846	UE spurious emissions structure correction for CA	11.12.0
03-2015	RP-67	RP-150382	2849	Removal of Pcmax requirements for UL inter-band CA in early release	11.12.0
03-2015	RP-67	RP-150384	2865	Band 28 UE emissions correction	11.12.0
03-2015	RP-67	RP-150384	2866	Implementation of CA configurations specified in later releases	11.12.0
07-2015	RP-68	RP-150954	2869	Intra-band contiguous CA reference sensitivity definition for Class D	11.13.0
07-2015	RP-68	RP-150954	2900	UE to UE co-existence between B42/B43	11.13.0
07-2015	RP-68	RP-150955	2908	Corrections on UL transmit power for CA receiver requirements	11.13.0
07-2015	RP-68	RP-150958	2916	Editorial CR for CA UE performance tests in 36.101 in Rel-11	11.13.0
07-2015	RP-68	RP-150954	2930	3.5 GHz out-of-band blocking	11.13.0
07-2015	RP-68	RP-150958	2942	Correction of CA performance tests (Rel-11)	11.13.0
07-2015	RP-68	RP-150958	2946	Updates to the definitions of CA capability (Rel-11)	11.13.0
07-2015	RP-68	RP-150955	2949	Clarification of PDSCH allocation in CSI PUSCH 3-0 felCIC tests (Rel-11)	11.13.0
07-2015	RP-68	RP-150954	2955	NS value for intra-band contiguous CA configurations not allowed A-MPR	11.13.0
07-2015	RP-68	RP-150957	2957r1	Receiver spurious emissions requirements for downlink-only bands	11.13.0
07-2015	RP-68	RP-150954	2970	Corrections to NS_22 and NS_23	11.13.0
07-2015	RP-68	RP-150954	2991	Clarification to spurious emission requirement for the edge of spurious domain	11.13.0
07-2015	RP-68	RP-150955	2995r1	Correction to CA_7C A-MPR in CA-NS_06	11.13.0
07-2015	RP-68	RP-150958	3001	CR for updating CA applicability rule in 36.101 in Rel-11	11.13.0
07-2015	RP-68	RP-150954	3017	EVM for Intra-band contiguous UL CA for non-equal Channel BWs	11.13.0
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
09-2015	RP-69	RP-151475	3038			Correction to RI test parameters in TS 36.101 (Rel-11)	11.14.0
09-2015	RP-69	RP-151483	3048			UE co-existence requirements between Band 42 and Japanese bands	11.14.0
09-2015	RP-69	RP-151476	3063			Correction to RC.2 TDD Nr. HARQ Proc. into TS36.101	11.14.0
09-2015	RP-69	RP-151475	3074			Correction to PDCCH/PCFICH test parameters in TS 36.101 (Rel-11)	11.14.0
09-2015	RP-69	RP-151475	3078			Correction to PMI delay in PMI test for TDD	11.14.0
09-2015	RP-69	RP-151475	3100			Correction on UE maximum output power class of Band 22 for UL MIMO	11.14.0
09-2015	RP-69	RP-151475	3163			Correction of applicability of CA_NS_31	11.14.0
12-2015	RP-70	RP-152132	3169a			Corrections to applicability of CSI requirements for low UE categories (Rel-11)	11.15.0
12-2015	RP-70	RP-152130	3200r1			CR: Removal of 1.4MHz MBMS test (Rel-11)	11.15.0
12-2015	RP-70	RP-152132	3203			Correction of the AMPR table for NS_14 in TS 36.101 R11	11.15.0
12-2015	RP-70	RP-152130	3230			Correction to reference channel for CQI requirements	11.15.0
12-2015	RP-70	RP-152132	3244 r1			CR on FRC for CDM-multiplexed DM RS	11.15.0
12-2015	RP-70	RP-152132	3247			Correction to physical channel for CQI reporting in type A test case	11.15.0
12-2015	RP-70	RP-152132	3267 r1			Clarification of Pcell support in 36.101 Rel-11 in CA scenarios	11.15.0
12-2015	RP-70	RP-152132	3271 r1			A-MPR correction for CA_NS_06 CA-7C non-contiguous RB allocation	11.15.0
12-2015	RP-70	RP-152131	3283			Missing RB allocation and OCNG Pattern for Cat 1 UEs in Multiple PMI CSI Reference Symbol tests	11.15.0
03-2016	RP-71	RP-160488	3379			Correction to Type A CQI test parameters in TS 36.101	11.16.0
03-2016	RP-71	RP-160488	3393	1		Beamforming model correction on TM10 DPS UE tests	11.16.0
03-2016	RP-71	RP-160487	3401			[Rel-11] NS_05 modification for PHS protection in Japan	11.16.0
03-2016	RP-71	RP-160488	3403			CQI reports in CoMP fading test	11.16.0
03-2016	RP-71	RP-160489	3434			Correction on UE category in Annex of TS 36.101	11.16.0
03-2016	RP-71	RP-160488	3450			Correction to TDD CQI Reporting for feICIC	11.16.0
03-2016	RP-71	RP-160488	3471			CR of editorial change on PHICH group and Ng in Rel-11	11.16.0
06/2016	RP-72	RP-161140	3536		F	Maintenance CR for demodulation performance requirements (Rel-11)	11.17.0
06/2016	RP-72	RP-161140	3612	-	F	CR: Maintenance CR for demodulation performance requirements (Rel-11)	11.17.0
06/2016	RP-72	RP-161141	3621	2	D	Editorial correction for TM4 MMSE-IRC PDSCH demodulation test	11.17.0
09/2016	RP-73	RP-161632	3653		A	Improving the single antenna port description in UL-MIMO clauses	11.18.0
09/2016	RP-73	RP-161784	3660		F	Correction of CA REFSENS harmonic formula	11.18.0
09/2016	RP-73	RP-161633	3669		F	CR: Update the power level setting for tests 8.3.1.2 and 8.3.2.3 (Rel-11)	11.18.0
09/2016	RP-73	RP-161633	3762		F	CR for fixing power level for TM9 dual layer test in Rel-11	11.18.0
09/2016	RP-73	RP-161633	3796	1	F	Correction of OCNG (Rel-11)	11.18.0

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