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Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Networks; LTE in the US Wireless Communications Service (WCS) Band Work Item Technical Report (Release 12)



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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

Previously the deployment of the 3GPP LTE technology in the bands 2305 to 2315 MHz and 2350 to 2360 MHz (known as the Wireless Communications Service band, or 'WCS' in the United States), could not be accommodated due to technical and operational constraints present in FCC regulations. This is commonly known as Block A (2305-2315/2350-2355 MHz) and Block B (2310-2315/2355-2360 MHz) in the WCS Band. The FCC on October 17, 2011 amended and confirmed the technical and operational characteristics for WCS which enable the deployment of LTE FDD technology in Blocks A & B in the frequency band covering 2305-2315 MHz and 2350-2360 MHz.

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] 3GPP TR 41.001: "GSM Release specifications".
- [3] 3GPP TR 21.912 (V3.1.0): "Example 2, using fixed text".
- [4] FCC Order (FCC-12-130): "Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band"
- [5] RP-121419, "New WI proposal: Addition of LTE WCS Band"
- [6] RP-121828, "Further information on WCS Band"
- [7] R4-130052, "Overview of FCC regulations and recommendations on 3GPP requirements for WCS Band"
- [8] R4-130737, "Regulatory requirements on output power and emissions mask for the WCS band"
- [9] R4-130912, "TR skeleton for WCS Band"
- [10] R4-130913, "UE output power and emission requirements for the WCS band,"
- [11] <http://www.coe.montana.edu/ee/rwolff/EE580/final%20projects/SDARSReport.pdf>

3 Definitions, symbols and abbreviations

3.1 Definitions

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

3.2 Symbols

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

Symbol format (EW)

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [x] 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 [x].

Abbreviation format (EW)

SDARS Satellite Digital Audio Radio System

4 Background

During RAN #57, a work item was approved for “LTE WCS Band” (RP-12149). This work item proposes specifications for the deployment of 3GPP LTE technology in the bands 2305 to 2315 MHz and 2350 to 2360 MHz (known as the Wireless Communications Service band, or ‘WCS’ in the United States). There are two blocks, Block A (2305-2310/2350-2355 MHz) and Block B (2310-2315/2355-2360 MHz) in the WCS Band.

Previously the deployment of the 3GPP LTE technology in the bands 2305 to 2315 MHz and 2350 to 2360 MHz (known as the Wireless Communications Service band, or ‘WCS’ in the United States), could not be accommodated due to technical and operational constraints present in FCC regulations. This is commonly known as Block A (2305-2315/2350-2355 MHz) and Block B (2310-2315/2355-2360 MHz) in the WCS Band. The FCC on October 17, 2011 amended and confirmed the technical and operational characteristics for WCS which enable the deployment of LTE FDD technology in Blocks A & B in the frequency band covering 2305-2315 MHz and 2350-2360 MHz.

On October 17, 2012, the USA Federal Communications Commission unanimously approved a joint proposal submitted by AT&T and SiriusXM to enable WCS licensees’ to use a total of 30 megahertz of spectrum in the 2.3 GHz band for wireless broadband services while protecting Satellite Digital Audio Radio Service (SDARS) operator Sirius XM Radio Inc against harmful interference. The details of the FCC Order is found in [4].

The 2.3 GHz band is divided into four blocks as follows (see Figure 1 below):

- A and B blocks are each 10 MHz of paired spectrum (2x5 MHz):

A block: 2305-2310, 2350-2355 MHz

B block: 2310-2315, 2355-2360 MHz

- C and D blocks are each 5 MHz unpaired (1x5 MHz):

C block: 2315-2320 MHz

D block: 2345-2350 MHz

Note: The C and D blocks will not be deployed at this time to allow for guardband limits for the SDARS service from 2320-2345 MHz.

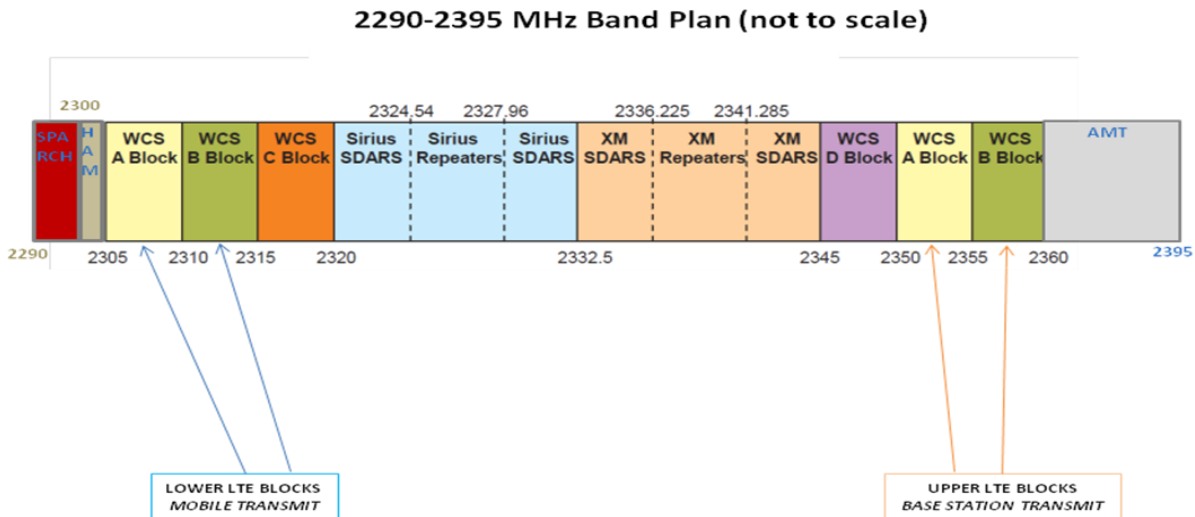


Figure 4-1: United States WCS 2.3 GHz Band Plan

5 Frequency band arrangements and regulatory background

The WCS band work item proposes to define a new band for LTE consisting of the A and B WCS blocks as shown below.

Table 5-1 Proposed WCS Band

Bandwidths	WCS Block	Uplink (UL) operating band BS receive UE transmit		Downlink (DL) operating band BS transmit UE receive		Duplex Mode
		WCS LOWER LTE BLOCKS		WCS UPPER LTE BLOCKS		
10+10 MHz	A+B	2305 MHz	–	2315 MHz	2350MHz – 2360 MHz	FDD
5+5 MHz	A	2305 MHz	–	2310MHz	2350MHz – 2355 MHz	FDD
5+5 MHz	B	2310 MHz	–	2315 MHz	2355MHz – 2360 MHz	FDD

The regulatory requirements pertaining to transmit power and emission masks provided in Appendix A of [4] are summarized below for the cases of interest.

5.1 Power limits and duty cycle

- (1) Base and fixed stations. For base and fixed stations transmitting in the 2305 – 2315 MHz band or the 2350 – 2360 MHz band:
 - (A) The average equivalent isotropically radiated power (EIRP) must not exceed 2,000 watts within any 5 megahertz of authorized bandwidth and must not exceed 400 watts within any 1 megahertz of authorized bandwidth.
 - (B) The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative

distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

- (2) **Mobile and portable stations.** For mobile and portable stations transmitting in the 2305 – 2315 MHz band or the 2350 – 2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305 – 2315 MHz and 2350 – 2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305 – 2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

(i) **Automatic transmit power control.** Mobile and portable stations transmitting in the 2305 – 2315 MHz band or in the 2350 – 2360 MHz band must employ automatic transmit power control when operating so the stations operate with the minimum power necessary for successful communications.

5.2 Emission limits

For operations in the 2305 – 2320 MHz band and 2345 – 2360 MHz band, the power of any emissions outside of a licensee's frequency band(s) of operation shall be attenuated below the transmitter power P (with averaging performed only during periods of transmission) within the licensed band(s) of operation, in watts, by the following amounts: Table 5-2.1 Emission limits for base and fixed stations operating in the 2305 – 2320 MHz band and the 2345 – 2360 MHz band:

Frequency range (outside the licensed band(s) of operation)	Minimum attenuation requirement in dB
2305 – 2320 MHz	$43 + 10 \log (P)$
2345 – 2360 MHz	$43 + 10 \log (P)$
2320 – 2345 MHz	$75 + 10 \log (P)$
2300 – 2305 MHz	$43 + 10 \log (P)$
2287.5 – 2300 MHz	$70 + 10 \log (P)$
2285 – 2287.5 MHz	$72 + 10 \log (P)$
Below 2285 MHz	$75 + 10 \log (P)$
2360 – 2362.5 MHz	$43 + 10 \log (P)$
2362.5 – 2365 MHz	$55 + 10 \log (P)$
2365 – 2367.5 MHz	$70 + 10 \log (P)$
2367.5 – 2370 MHz	$72 + 10 \log (P)$
Above 2370 MHz	$75 + 10 \log (P)$

Table 5-2.2 Emission limits for mobile and portable stations operating in the 2305 – 2315 MHz and 2350 – 2360 MHz bands

Frequency range (outside the licensed band(s) of operation)	Minimum attenuation requirement in dB
2305 – 2320 MHz	$43 + 10 \log (P)$
2345 – 2360 MHz	$43 + 10 \log (P)$

2320 – 2324 MHz	$55 + 10 \log (P)$
2341 – 2345 MHz	$55 + 10 \log (P)$
2324 – 2328 MHz	$61 + 10 \log (P)$
2337 – 2341 MHz	$61 + 10 \log (P)$
2328 – 2337 MHz	$67 + 10 \log (P)$
2300 – 2305 MHz	$43 + 10 \log (P)$
2296 – 2300 MHz	$55 + 10 \log (P)$
2292 – 2296 MHz	$61 + 10 \log (P)$
2288 – 2292 MHz	$67 + 10 \log (P)$
Below 2288 MHz	$70 + 10 \log (P)$
2360 – 2365 MHz	$43 + 10 \log (P)$
Above 2365 MHz	$70 + 10 \log (P)$

- (1) **Measurement Procedure:** Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the channel blocks at 2305, 2310, 2315, 2320, 2345, 2350, 2355, and 2360 MHz, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.*, 1 MHz). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.3 3GPP requirements in accordance with FCC regulations

The following recommendations on defining the 3GPP requirements for the WCS band in accordance with the FCC regulations have been approved in RAN4.

- 1) Not to define the 3GPP requirements for the WCS band in the RAN4 specifications corresponding to the FCC regulations on Power Limits and Duty Cycle.
- 2) To define the 3GPP requirements for the WCS band in the RAN4 specifications according to the FCC regulations on Emission Limits, without the need to perform further coexistence studies in RAN4.
- 3) To study whether new NS_value and A-MPR are required to be defined in the RAN4 specifications for UE to meet the FCC regulations on Emission Limits.
- 4) Not to define the 3GPP requirements for the WCS band in the RAN4 specifications corresponding to the FCC regulations on Power strength limits.
- 5) Not to define the 3GPP requirements for the WCS band in the RAN4 specifications corresponding to the FCC regulations on Protection from interference.

6 List of band specific issues for the WCS band

This is the list of issues to resolve during the WI on the WCS band

- General issues
 - The FCC out-of-band emissions frequency limits
 - Operating bands
 - Carrier frequency and EARFCN
 - E-UTRA specific issues
 - UE
 - Output power
 - Emission mask
 - Network signaling and A-MPR
 - UE REFSSENS
 - UE in-band blocking
 - BS
 - Emission mask
-

7 General issues

7.1 The FCC out-of-band emissions frequency limits

3GPP specified spurious emissions in the frequency range from 9 kHz to 12.75 GHz. The general spurious emissions for an operating band above 1GHz and below 12.75GHz is -30 dBm/MHz for the UE and -13dBm/MHz (Category A) or -30dBm/MHz (Category B) for the BS.

The out-of-band emissions specified by the FCC for the WCS band are equivalent to the absolute emission limits of:

- -45dBm/MHz below 2285 MHz and above 2370 MHz for the BS
- -40dBm/MHz below 2288 MHz and above 2365 MHz for the UE

Where there is no upper or lower frequency limits to which these requirements apply.

Specifying this requirement down to 9kHz and up to 12.75GHz would require a more stringent spurious emissions for the WCS than for any other band and more stringent than recommended in ITU-R SM.329. At the same time, these requirements were specified for co-existence between the WCS band and adjacent services at 2200-2290 MHz (Federal Satellite Systems) and 2370-2395 MHz (Aeronautical Mobile Telemetry or AMT).

The emission limits of -45dBm/MHz (BS) and -40dBm/MHz(UE) can be limited down to 2200 MHz and up to 2395 MHz while the the general spurious emission should be required from 9 kHz-2200 MHz and 2395 MHz-12.75 GHz. We also note that simply complying with 3GPP requirements does not obviate the need for equipment to also comply with applicable regulatory requirements.

8 Study of E-UTRA specific issues

8.1 UE transmitter requirements

8.1.1 Output power

We propose that the maximum output power be set to 23 dBm with tolerance of +2/-2 dB.

Table 8.1.1-1. UE power class

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
[30]					23	+2/-2		

8.1.2 UE out-of-band emissions (additional spectrum emissions)

The WCS band will adhere to the additional spectrum mask requirements commonly imposed via NS_03, NS_11, and NS_20. Thus, NS_xy for the WCS band will be added to applicability of Table 6.6.2.2.1-1. This accounts for the FCC emission requirements over the range 2300 - 2320 MHz. The remainder of the emission requirements, which are stricter than those in this additional spectrum emission mask, are captured as spurious emissions.

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", "NS_20", or "NS_xy" 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.

Table 6.6.2.2.1-1: Additional requirements

Δf_{OOB} (MHz)	Spectrum emission limit (dBm)/ Channel bandwidth						Measurement bandwidth
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
± 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

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.

8.1.3 Emission mask and UE coexistence

The UE coexistence table will include the emission requirements, applicable when NS_{xy} is signaled by the network in accordance with the agreement in [5]. Additionally, the UE coexistence table must also include coexistence between the WCS band and other bands operating in North America where the band is expected to be deployed. These include bands 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, and 41. In most of these cases, the frequency separation is large enough that -50 dBm/MHz can be met. However, in the case of Band 13, its uplink has a 3rd harmonic component which lands in the downlink of the WCS band. Therefore, a harmonic exception is proposed to be allowed for Band 13.

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	Note	
1	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 3, 34	F _{DL_low}	-	F _{DL_high}	-50	1	15
	Frequency range	1880		1895	-40	1	15,27
	Frequency range	1895		1915	-15.5	5	15,27
	Frequency range	1915		1920	+1.6	5	15,27
	Frequency range	1884.5	-	1915.7	-41	0.3	6, 8, 15
	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, [30], 41, 42	F _{DL_low}	-	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, 43, 44	F _{DL_low}	-	F _{DL_high}	-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 _{DL_high}	-50	1	13
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	13
4	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 25, 26, 27, 28, 29, [30], 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
5	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 25, 28, 29, [30], 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 41	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 26	859	-	869	-27	1	
6	E-UTRA Band 1, 9, 11, 34	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	860	-	875	-37	1	
	Frequency range	875	-	895	-50	1	
	Frequency range	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, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
8	E-UTRA Band 1, 20, 28, 33, 34, 38, 39, 40	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA band 3	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA band 7	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 8	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}	-50	1	23
	Frequency range	860	-	890	-40	1	15, 23
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 23
9	E-UTRA Band 1, 11, 18, 19, 21, 26, 28, 34	F _{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	
10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, [30], 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
11	E-UTRA Band 1, 11, 18, 19, 21, 28, 34	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
12	Frequency range	1839.9	-	1879.9	-50	1	
	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, [30], 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}	-	F_{DL_high}	-50	1	15
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 26, 27, 29, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	-	805	-35	0.00625	11, 15
	E-UTRA Band 14	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 24, [30]	F_{DL_low}	-	F_{DL_high}	-50	1	2
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-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, [30], 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}	-	F_{DL_high}	-50	1	15
18	E-UTRA Band 1, 11, 21, 34	F_{DL_low}	-	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	
19	E-UTRA Band 1, 11, 21, 28, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	860	-	890	-40	1	9, 15
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
20	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34, 43	F_{DL_low}	-	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
21	E-UTRA Band 11	F_{DL_low}	-	F_{DL_high}	-35	1	10, 15
	E-UTRA Band 1, 18, 19, 28, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 21	F_{DL_low}	-	F_{DL_high}	-50	1	10
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
22	E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28, 33, 34, 38, 39, 40, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	3510	-	3525	-40	1	15
	Frequency range	3525	-	3590	-50	1	
23	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	14, 15
	Frequency range	1998	-	1999	-21	1	14, 15
	Frequency range	1997	-	1998	-27	1	14, 15
	Frequency range	1996	-	1997	-32	1	14, 15
	Frequency range	1995	-	1996	-37	1	14, 15
24	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1990	-	1995	-40	1	14, 15
25	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, [30], 41, 42	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43	F_{DL_low}	-	F_{DL_high}	-50	1	2
26	E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 22, 23, 24, 25, 26, 29, [30], 34, 40, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	703	-	799	-50	1	
		799	-	803	-40	1	15

	Frequency range	851	-	859	-53	0.00625	20
	E-UTRA Band 27	F _{DL_low}	-	859	-32	1	20
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
27	E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13, 14, 17, 22, 23, 25, 26, 27, 29, 41, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	799	-	805	-35	0.00625	
		790	-	F _{DL_high}	-32	1	16
	E-UTRA Band 28	F _{DL_low}	-	790	-50	1	
28	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 25, 26, 27, 34, 38, 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 1, 4, 10, 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}	-50	1	19, 24
	E-UTRA Band 1	F _{DL_low}	-	F _{DL_high}	-50	1	19, 25
	Frequency range	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	
[30]	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, [30], 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2200	-	2288	-40	1	15, X
	Frequency range	2288	-	2292	-37	1	15, X
	Frequency range	2292	-	2296	-31	1	15, X
	Frequency range	2296	-	2300	-25	1	15, X
	Frequency range	2320	-	2324	-25	1	15, X
	Frequency range	2324	-	2328	-31	1	15, X
	Frequency range	2328	-	2332	-37	1	15, X
	Frequency range	2332	-	2395	-40	1	15, X
...							
33	E-UTRA Band 1, 7, 8, 20, 22, 34, 38, 39, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	5
	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, 21, 22, 26, 28, 33, 38, 39, 40, 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	5
35							
36							
37			-				
38	E-UTRA Band 1, 3, 8, 20, 22, 28, 29, 33, 34, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22, 26
39	E-UTRA Band 22, 34, 40, 42, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
40	E-UTRA Band 1, 3, 22, 26, 27, 33, 34, 39, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
41	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, [30]	F _{DL_low}	-	F _{DL_high}	-50	1	
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 43	F _{DL_low}	-	F _{DL_high}	-50	1	3
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	3
	E-UTRA Band 22	F _{DL_low}	-	F _{DL_high}	[-50]	[1]	3
44	E-UTRA Band 1, 3, 5, 8, 34, 38, 39, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2

- NOTE 1: F_{DL_low} and F_{DL_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 2nd, 3rd, 4th [or 5th] 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 2nd, 3rd or 4th harmonic totally or partially overlaps the measurement bandwidth (MBW).
- 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: Applicable when NS_05 in section 6.6.3.3.1 is signalled by the network.
- 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: Applicable when NS_08 in subclause 6.6.3.3.3 is signalled by the network
- NOTE 10: Applicable when NS_09 in subclause 6.6.3.3.4 is signalled by the network
- 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: To meet this requirement NS_11 value shall be signalled when operating in 2000-2020 MHz
- NOTE 15: These requirements also apply for the frequency ranges that are less than Δf_{OoB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.
- NOTE 16: Applicable when NS_16 in subclause 6.6.3.3.9 is signalled by the network.
- 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: Applicable when NS_15 in subclause 6.6.3.3.8 is signalled by the network.
- NOTE 21: This requirement is applicable for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 2552 - 2560 MHz. No other restrictions apply for carriers with bandwidths confined in 2500-2570 MHz.
- NOTE 22: This requirement is applicable for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 2597 - 2605 MHz. No other restrictions apply for carriers with bandwidths confined in 2570-2615 MHz. For assigned carriers with bandwidths overlapping the frequency range 2615-2620 MHz the requirements apply with the maximum output power configured to +20 dBm in the IE *P-Max*.
- NOTE 23: For carriers of 5 MHz channel bandwidth with carrier center frequencies (F_c) in the range $902.5\text{MHz} \leq F_c < 907.5\text{MHz}$, the requirement applies for uplink transmission bandwidths less than or equal to 20 RB. No restrictions apply in the range $907.5\text{MHz} \leq F_c \leq 912.5\text{MHz}$. For carriers of 10 MHz channel bandwidth, the requirement only applies for $F_c = 910\text{MHz}$ and uplink transmission bandwidths 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 2nd 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 2nd 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 3rd 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 3rd 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 an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1930 - 1938 MHz. This requirement is applicable without any other uplink transmission bandwidth restriction for channel bandwidths within the range 1920 - 1980 MHz.
- NOTE X: Applicable when NS_xy is signalled by the network.

8.1.2 Network signaling and A-MPR

Table 8.1.2-1. NS value

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS _{xy}	6.6.2.2.1 6.6.3.2	[30]	5, 10		Table x.y.z

Table 8.1.2-2. A-MPR table

Parameters	Region A		Region B		Region C
RB _{start}	FFS	FFS	FFS	FFS	FFS
L _{CRB} [RBs]	FFS	FFS	FFS	FFS	FFS
A-MPR [dB]	FFS	FFS	FFS	FFS	FFS
NOTE 1: RB _{start} indicates the lowest RB index of transmitted resource blocks					
NOTE 2: L _{CRB} 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-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.					

8.1.3 Emission mask and UE coexistence

The UE coexistence table will include the emission requirements, applicable when NS_{xy} is signaled by the network in accordance with the agreement in [5]. Additionally, the UE coexistence table must also include coexistence between the WCS band and other bands operating in North America where the band is expected to be deployed. These include bands 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, and 41. In most of these cases, the frequency separation is large enough that -50 dBm/MHz can be met. However, in the case of Band 13, its uplink has a 3rd harmonic component which lands in the downlink of the WCS band. Therefore, a harmonic exception is proposed to be allowed for Band 13.

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	Note	
1	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 3, 34	F _{DL_low}	-	F _{DL_high}	-50	1	15
	Frequency range	1880		1895	-40	1	15,27
	Frequency range	1895		1915	-15.5	5	15,27
	Frequency range	1915		1920	+1.6	5	15,27
	Frequency range	1884.5	-	1915.7	-41	0.3	6, 8, 15
	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, [30], 41, 42	F _{DL_low}	-	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, 43, 44	F _{DL_low}	-	F _{DL_high}	-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 _{DL_high}	-50	1	13
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	13
4	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 25, 26, 27, 28, 29, [30], 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
5	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 25, 28, 29, [30], 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 41	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 26	859	-	869	-27	1	
6	E-UTRA Band 1, 9, 11, 34	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	860	-	875	-37	1	
	Frequency range	875	-	895	-50	1	
	Frequency range	1884.5	-	1919.6	-41	0.3	7
	Frequency range	1884.5	-	1915.7	-41	0.3	8
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, [30], 33, 34, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26
	Frequency range	2595	-	2620	-40	1	15, 21
8	E-UTRA Band 1, 20, 28, 33, 34, 38, 39, 40	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA band 3	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA band 7	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 8	F _{DL_low}	-	F _{DL_high}	-50	1	15
	E-UTRA Band 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}	-50	1	23
	Frequency range	860	-	890	-40	1	15, 23
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 23
9	E-UTRA Band 1, 11, 18, 19, 21, 26, 28, 34	F _{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	
10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, [30], 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
11	E-UTRA Band 1, 11, 18, 19, 21, 28, 34	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
12	Frequency range	1839.9	-	1879.9	-50	1	
	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, [30], 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}	-	F_{DL_high}	-50	1	15
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 26, 27, 29, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	-	805	-35	0.00625	11, 15
	E-UTRA Band 14	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 24, [30]	F_{DL_low}	-	F_{DL_high}	-50	1	2
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-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, [30], 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}	-	F_{DL_high}	-50	1	15
18	E-UTRA Band 1, 11, 21, 34	F_{DL_low}	-	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	
19	E-UTRA Band 1, 11, 21, 28, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	860	-	890	-40	1	9, 15
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
20	E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34, 43	F_{DL_low}	-	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
21	E-UTRA Band 11	F_{DL_low}	-	F_{DL_high}	-35	1	10, 15
	E-UTRA Band 1, 18, 19, 28, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 21	F_{DL_low}	-	F_{DL_high}	-50	1	10
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	945	-	960	-50	1	
22	E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28, 33, 34, 38, 39, 40, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	3510	-	3525	-40	1	15
	Frequency range	3525	-	3590	-50	1	
23	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	14, 15
	Frequency range	1998	-	1999	-21	1	14, 15
	Frequency range	1997	-	1998	-27	1	14, 15
	Frequency range	1996	-	1997	-32	1	14, 15
	Frequency range	1995	-	1996	-37	1	14, 15
24	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, [30], 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1990	-	1995	-40	1	14, 15
25	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, [30], 41, 42	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 2	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 25	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 43	F_{DL_low}	-	F_{DL_high}	-50	1	2
26	E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 22, 23, 24, 25, 26, 29, [30], 34, 40, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 41	F_{DL_low}	-	F_{DL_high}	-50	1	2
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	703	-	799	-50	1	
		799	-	803	-40	1	15

	Frequency range	851	-	859	-53	0.00625	20
	E-UTRA Band 27	F _{DL_low}	-	859	-32	1	20
	Frequency range	945	-	960	-50	1	
	Frequency range	1839.9	-	1879.9	-50	1	
27	E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13, 14, 17, 22, 23, 25, 26, 27, 29, [30], 41, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	799	-	805	-35	0.00625	
		790	-	F _{DL_high}	-32	1	16
	E-UTRA Band 28	F _{DL_low}	-	790	-50	1	
28	E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 25, 26, 27, 34, 38, 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 1, 4, 10, 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}	-50	1	19, 24
	E-UTRA Band 1	F _{DL_low}	-	F _{DL_high}	-50	1	19, 25
	Frequency range	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	
[30]	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, [30], 38, 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2200	-	2288	-40	1	15, X
	Frequency range	2288	-	2292	-37	1	15, X
	Frequency range	2292	-	2296	-31	1	15, X
	Frequency range	2296	-	2300	-25	1	15, X
	Frequency range	2320	-	2324	-25	1	15, X
	Frequency range	2324	-	2328	-31	1	15, X
	Frequency range	2328	-	2332	-37	1	15, X
	Frequency range	2332	-	2395	-40	1	15, X
...							
33	E-UTRA Band 1, 7, 8, 20, 22, 34, 38, 39, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	5
	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, 21, 22, 26, 28, 33, 38, 39, 40, 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	5
35							
36							
37			-				
38	E-UTRA Band 1, 3, 8, 20, 22, 28, 29, [30], 33, 34, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22, 26
39	E-UTRA Band 22, 34, 40, 42, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
40	E-UTRA Band 1, 3, 22, 26, 27, 33, 34, 39, 42, 43, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
41	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, [30]	F _{DL_low}	-	F _{DL_high}	-50	1	
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 43	F _{DL_low}	-	F _{DL_high}	-50	1	3
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	3
	E-UTRA Band 22	F _{DL_low}	-	F _{DL_high}	[-50]	[1]	3
44	E-UTRA Band 1, 3, 5, 8, 34, 38, 39, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2

- NOTE 1: F_{DL_low} and F_{DL_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 2nd, 3rd, 4th [or 5th] 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 2nd, 3rd or 4th harmonic totally or partially overlaps the measurement bandwidth (MBW).
- 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: Applicable when NS_05 in section 6.6.3.3.1 is signalled by the network.
- 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: Applicable when NS_08 in subclause 6.6.3.3.3 is signalled by the network
- NOTE 10: Applicable when NS_09 in subclause 6.6.3.3.4 is signalled by the network
- 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: To meet this requirement NS_11 value shall be signalled when operating in 2000-2020 MHz
- NOTE 15: These requirements also apply for the frequency ranges that are less than Δf_{OoB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.
- NOTE 16: Applicable when NS_16 in subclause 6.6.3.3.9 is signalled by the network.
- 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: Applicable when NS_15 in subclause 6.6.3.3.8 is signalled by the network.
- NOTE 21: This requirement is applicable for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 2552 - 2560 MHz. No other restrictions apply for carriers with bandwidths confined in 2500-2570 MHz.
- NOTE 22: This requirement is applicable for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 2597 - 2605 MHz. No other restrictions apply for carriers with bandwidths confined in 2570-2615 MHz. For assigned carriers with bandwidths overlapping the frequency range 2615-2620 MHz the requirements apply with the maximum output power configured to +20 dBm in the IE *P-Max*.
- NOTE 23 For carriers of 5 MHz channel bandwidth with carrier center frequencies (F_c) in the range $902.5\text{MHz} \leq F_c < 907.5\text{MHz}$, the requirement applies for uplink transmission bandwidths less than or equal to 20 RB. No restrictions apply in the range $907.5\text{MHz} \leq F_c \leq 912.5\text{MHz}$. For carriers of 10 MHz channel bandwidth, the requirement only applies for $F_c = 910\text{MHz}$ and uplink transmission bandwidths 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 2nd 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 2nd 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 3rd 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 3rd 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 an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1930 - 1938 MHz. This requirement is applicable without any other uplink transmission bandwidth restriction for channel bandwidths within the range 1920 - 1980 MHz.
- NOTE X: Applicable when NS_xy is signalled by the network.

8.2 UE receiver requirements

8.2.1 UE REFSSENS

To establish reference sensitivity, we first evaluate the uplink configuration required to minimize the effect of Tx noise. Based on methods used previously for other bands, we find that the uplink configuration should be limited to 25 RB's for reference sensitivity. This enables a full allocation for the 5 MHz channel. For the 10 MHz channel, the 25 RB's are placed closest to the downlink in the worst case location.

Table 8.2.1-1. Uplink configuration for reference sensitivity

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
[30]			25	25 ¹			FDD
NOTE 1: ¹ 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).							

The ratio of the passband to the duplex gap is small so it is expected that the isolation requirements for the duplexer can be met without undue insertion loss. We furthermore assume that the additional emission requirements of NS_{xy} have been addressed by A-MPR, as described previously, rather than by stringent filtering requirements. However, the ISM band is in proximity and will require filter mitigation. Furthermore, there may be the need to provide filter attenuation against in-band blockers. Tentatively, we propose the reference sensitivity for WCS as -100 dBm and -97 dBm for 5 MHz and 10 MHz channel bandwidths, respectively.

Table 8.2.1-2. Reference sensitivity

Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
[30]			[-100]	[-97]			FDD

8.2.2 UE ACS and blocking

We do not foresee any specialized ACS requirements for this band. However, there needs to be an additional in-band blocking requirement to accommodate SDA RS repeaters operating in nearby spectrum assignments in the range 2336.2 – 2341.3 MHz. We therefore propose to apply the conventional ACS and to create a new in-band blocking case for the WCS band (Case 5), see 8.2.2.1.

Table 8.2.2-1. In-band blocking

E-UTRA band	Parameter	Unit	Case 1	Case 2	Case 3	Case 4	Case 5
	$P_{\text{Interferer}}$	dBm	-56	-44	-30	-30	-38
	$F_{\text{Interferer}}$ (offset)	MHz	$= -BW/2 - F_{\text{offset, case 1}}$ & $= +BW/2 + F_{\text{offset, case 1}}$	$\leq -BW/2 - F_{\text{offset, case 2}}$ & $\geq +BW/2 + F_{\text{offset, case 2}}$	$-BW/2 - 15$ & $-BW/2 - 9$	$-BW/2 - 10$	$\leq -BW/2 - 11$
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44	$F_{\text{Interferer}}$	MHz	(Note 2)	$F_{\text{DL_low}} - 15$ to $F_{\text{DL_high}} + 15$			
12	$F_{\text{Interferer}}$	MHz	(Note 2)	$F_{\text{DL_low}} - 10$ to $F_{\text{DL_high}} + 15$		$F_{\text{DL_low}} - 10$	
17	$F_{\text{Interferer}}$	MHz	(Note 2)	$F_{\text{DL_low}} - 9$ to $F_{\text{DL_high}} + 15$	$F_{\text{DL_low}} - 15$ and $F_{\text{DL_low}} - 9$		
[30]	$F_{\text{Interferer}}$	MHz	(Note 2)	$F_{\text{DL_low}} - 15$ to $F_{\text{DL_high}} + 15$			$F_{\text{DL_low}} - 11$
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							
NOTE 2: For each carrier frequency the requirement is valid for two frequencies:							
a. the carrier frequency $-BW/2 - F_{\text{offset, case 1}}$ and							
b. the carrier frequency $+BW/2 + F_{\text{offset, case 1}}$							
NOTE 3: $F_{\text{Interferer}}$ range values for unwanted modulated interfering signal are interferer center frequencies							
NOTE 4: Case 3 and Case 4 only apply to assigned UE channel bandwidth of 5 MHz							

Table 8.2.2-2. Out of band blocking

E-UTRA band	Parameter	Units	Frequency			
			range 1	range 2	range 3	range 4
			$P_{\text{Interferer}}$	dBm	-44	-30
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, [30], 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44	$F_{\text{Interferer}}$ (CW)	MHz	$F_{\text{DL_low}} - 15$ to $F_{\text{DL_low}} - 60$	$F_{\text{DL_low}} - 60$ to $F_{\text{DL_low}} - 85$	$F_{\text{DL_low}} - 85$ to 1 MHz	-
			$F_{\text{DL_high}} + 15$ to $F_{\text{DL_high}} + 60$	$F_{\text{DL_high}} + 60$ to $F_{\text{DL_high}} + 85$	$F_{\text{DL_high}} + 85$ to +12750 MHz	-
2, 5, 12, 17	$F_{\text{Interferer}}$	MHz	-	-	-	$F_{\text{UL_low}} - F_{\text{UL_high}}$
NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.						

8.2.2.1 SDARS terrestrial repeaters

XM and Sirius deploy both terrestrial repeaters in the mid-frequencies of their spectrum. As outlined in [11], there were about 105 Sirius terrestrial repeaters and more than 1000 XM terrestrial repeaters by 2004, many of them located in urban areas, where the WCS will also be used. Interference may then happen.

The XM and Sirius terrestrial repeaters are allocated at 11.25 MHz and 23.75 MHz, respectively, from the WCS DL operating band edge, as shown in Figure 8.2.2.1-1

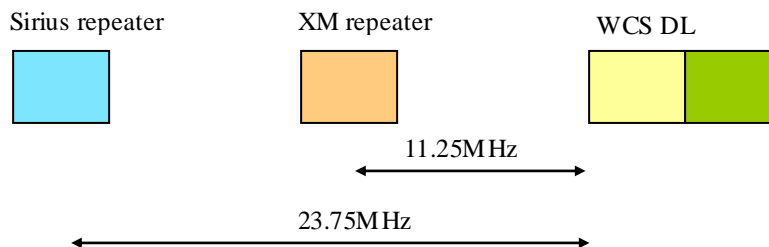


Figure 8.2.2.1-1. WCS DL and SDARS terrestrial repeaters allocation

In terms of interferer frequency offset, the interfering signal from the XM repeater at an offset that corresponds to the standard in-band blocking requirements w r t the WCS receive band, while the Sirius repeater is almost at half-duplex offset.

The standard in-band blocking level at the offset corresponding to the XM repeater interferer is -44 dBm (for a 5 MHz LTE interferer), which would correspond to a separation distance of around 280 m assuming in free-space and, the same repeater antenna discrimination. The latter may be smaller at a larger separation distance, which means that the actual separation distance required is larger than 280m at the -44 dBm interferer level.

The Sirius repeater interferer is almost a half-duplex blocker, but the wideband intermodulation response with the own TX falls just below the WCS receive band. Furthermore, it is anticipated that the receive filter at 23.7 MHz will supply sufficient rejection for the Sirius repeater interference so that it would not become a problem, regardless of duplex filter technology used.

The terrestrial repeater power is specified in [1] as 12 kW EIRP while the XM terrestrial repeaters typically transmit at lower power, up to 7kW. An initial assessment indicates that a UE can get as close as 30m from a SDARS repeater. Assuming the SDARS antenna height to be 100m, its discrimination below the repeater antenna in the order of 25 dB and the UE antenna gain as 0dBi, a victim UE is subject to a blocker of -37dBm (in free space)

The WCS UEs should have the capability to reject the blocking signal from the XM terrestrial repeaters. Looking at the in-band blocking requirements in TS36.101, this blocking level is higher than what is specified as the general in-band blocking requirements. Therefore, a new in-band blocking requirement, Case 5, is added to the WCS band. The power of the interferer signal for this case is defined as -38 dBm at 11MHz from the DL of the WCS band.

<endfchanges >

8.3 Additional spurious emissions

Table 8.3-1 shows how to specify the FCC out-of band emissions outside the range 2345-2362.5MHz. These emissions are defined as additional BS spurious emissions for Band [30]. More specifically:

- The FCC requirement at 2320-2345MHz and below 2285 MHz is specified as a minimum attenuation level of $75+10\log P$ with 1 MHz measurement bandwidth (or the equivalent -45dBm/MHz), while the attenuation required between 2285 and 2320 MHz is more relaxed. The BS own UL protection (2305-2315 MHz for the WCS band) is specified in 3GPP as -96dBm/100kHz. Therefore, the requirement below 2345 MHz can be kept as -45dBm/MHz.

- The 3GPP general spurious emissions apply between 9 kHz - 2200 MHz and 2395 MHz– 12.75 GHz

Table 8.3-1: Additional BS Spurious emissions limits for Band [30]

Frequency range	Maximum Level	Measurement Bandwidth	Note
2200 MHz ↔ 2345 MHz	-45 dBm	1 MHz	
2362.5 MHz ↔ 2365 MHz	-25 dBm	1 MHz	
2365 MHz ↔ 2367.5 MHz	-40 dBm	1 MHz	
2367.5 MHz ↔ 2370 MHz	-42 dBm	1 MHz	
2370 MHz ↔ 2395 MHz	-45 dBm	1 MHz	

9 Channel numbering for E-UTRA, MSR

9.1 Band and channel numbering for E-UTRA

Band and channel numbering are conventionally not decided until near completion of the work item to avoid unnecessary shuffling of numbers in the event that the work item is not completed on schedule or other new band work items also scheduled for closure at the same time do not complete on schedule. We note that both the WCS band and the LTE 450 band are expected to complete at RAN #60 in June.

One possible outcome is that the WCS band is assigned Band [30] and the LTE 450 band is assigned Band [31]. In that case, the channel numbers for the WCS band would be as shown below in **Error! Reference source not found..**

Table 9.1-1. EARFCN number in the event that WCS band is assigned Band 30

E-UTRA Operating Band	Downlink			Uplink		
	F _{DL_low} (MHz)	N _{Offs-DL}	Range of N _{DL}	F _{UL_low} (MHz)	N _{Offs-UL}	Range of N _{UL}
[30]	2350	[9770]	[9770 – 9869]	2305	[27660]	[27660 – 27759]

10 Required changes to E-UTRA, MSR specifications

The required changes to the 3GPP specifications for the new band are summarised in a Table 10-1.

Table 10-1: Overview of 3GPP specifications with required changes

3GPP specification	Clause in TR 30.007 where the required changes are given	Clause in the present document identifying additional changes
TS 36.101	8.2.1.1	
TS 36.104	8.2.1.2	
TS 36.113	8.2.1.4	
TS 36.124	8.2.1.5	
TS 36.133	8.2.1.6	
TS 36.141	8.2.1.7	
TS 36.307	8.2.1.9	
TS 25.101	8.2.2.1	
TS 25.104	8.2.2.3	
TS 25.123	8.2.2.7	
TS 25.133	8.2.2.9	
TS 25.141	8.2.2.10	
TS 25.461	8.2.2.15	
TS 25.466	8.2.2.16	
TS 37.104	8.2.3.1	
TS 37.113	8.2.2.2	
TS 37.141	8.2.2.3	

Annex A

Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2013-06	60	RP-130731			Initial Release v1.0.0		