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IMT cellular networks;
Harmonised Standard for access to radio spectrum;
Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA)
User Equipment (UE)

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Mobile Standards Group (MSG).

For non-EU countries the present document may be used for regulatory (Type Approval) purposes.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A-1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

The present document is part 13 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.12].

This version of the harmonized standard includes the following revisions:

- Revision of the maximum output power requirements outlined in clause 4.2.2.
- Inclusion of requirements for band 41.
- Inclusion of Additional spurious emissions limits for frequency range 470 to 694 MHz to protect Broadband Public Protection and Disaster Relief (BB-PPDR) and Digital Terrestrial Television (DTT) operations.
- Inclusion of specific requirements for bands 72, 87, and 88 to protect Broadband Public Protection and Disaster Relief (BB-PPDR) and Digital Terrestrial Television (DTT) operations.

National transposition dates	
Date of adoption of this EN:	1 October 2024
Date of latest announcement of this EN (doa):	31 January 2025
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Date of withdrawal of any conflicting National Standard (dow):	31 July 2026

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the Radio Equipment Directive [i.2]. The present document is produced following the guidance in ETSI EG 203 336 [i.3] as applicable.

1 Scope

The present document applies to the following radio equipment type:

- User Equipment for Evolved Universal Terrestrial Radio Access (E-UTRA).

This radio equipment type is capable of operating in all or any part of the frequency bands given in tables from 1-1 through 1-5.

Table 1-1: E-UTRA UE operating bands

E-UTRA Band	Direction of UE transmission	E-UTRA operating bands	Related EC/ECC decision
1	Transmit	1 920 MHz to 1 980 MHz	[i.21] and [i.22]
	Receive	2 110 MHz to 2 170 MHz	
3	Transmit	1 710 MHz to 1 785 MHz	[i.19] and [i.20]
	Receive	1 805 MHz to 1 880 MHz	
7	Transmit	2 500 MHz to 2 570 MHz	[i.24] and [i.25]
	Receive	2 620 MHz to 2 690 MHz	
8	Transmit	880 MHz to 915 MHz	[i.19] and [i.20]
	Receive	925 MHz to 960 MHz	
20	Transmit	832 MHz to 862 MHz	[i.6] and [i.7]
	Receive	791 MHz to 821 MHz	
22	Transmit	3 410 MHz to 3 490 MHz	[i.26] and [i.27]
	Receive	3 510 MHz to 3 590 MHz	
28 (see note 6)	Transmit	703 MHz to 748 MHz	[i.14] and [i.15]
	Receive	758 MHz to 803 MHz	
31	Transmit	452,5 MHz to 457,5 MHz	[i.16]
	Receive	462,5 MHz to 467,5 MHz	
32 (see note 1) (see note 2)	Transmit	N/A	
	Receive	1 452 MHz to 1 496 MHz	[i.17] and [i.18]
33	Transmit and Receive	1 900 MHz to 1 920 MHz	[i.22]
34	Transmit and Receive	2 010 MHz to 2 025 MHz	[i.22]
38	Transmit and Receive	2 570 MHz to 2 620 MHz	[i.24] and [i.25]
40	Transmit and Receive	2 300 MHz to 2 400 MHz	[i.23]
41 (note 7)	Transmit and Receive	2 496 MHz to 2 690 MHz	[i.24] and [i.25]
42	Transmit and Receive	3 400 MHz to 3 600 MHz	[i.26] and [i.27]
43	Transmit and Receive	3 600 MHz to 3 800 MHz	[i.26] and [i.27]
46 (see note 3) (see note 4)	Transmit and Receive	5 150 MHz to 5 925 MHz	[i.29] and [i.30]
65 (see note 5)	Transmit	1 920 MHz to 2 010 MHz	[i.21], [i.22] and [i.28]
	Receive	2 110 MHz to 2 200 MHz	
67	Transmit	N/A	
	Receive	738 MHz to 758 MHz	[i.14] and [i.15]
68	Transmit	698 MHz to 728 MHz	[i.14] and [i.15]
	Receive	753 MHz to 783 MHz	
69 (see note 1)	Transmit	N/A	
	Receive	2 570 MHz to 2 620 MHz	[i.24] and [i.25]
72	Transmit	451 MHz to 456 MHz	[i.16]
	Receive	461 MHz to 466 MHz	
87	Transmit	410 MHz to 415 MHz	[i.16]
	Receive	420 MHz to 425 MHz	
88	Transmit	412 MHz to 417 MHz	[i.16]
	Receive	422 MHz to 427 MHz	

NOTE 1: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.
NOTE 2: In Europe, according to [i.17] and [i.18], radio equipment in band 32 operates between 1 452 MHz and 1 492 MHz.
NOTE 3: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3. In Europe according to [i.29] and [i.30], radio equipment in band 46 operates between 5 150 MHz and 5 725 MHz as in table 1-1A.
NOTE 4: In this version of the present document, restricted to E-UTRA DL operation when carrier aggregation is configured.
NOTE 5: A UE that complies with the E-UTRA Band 65 minimum requirements in the present document also complies with the E-UTRA Band 1 minimum requirements. This band includes two frequency ranges that are harmonised in Europe:
a) According to [i.21] and [i.22], radio equipment in band n65 operates between 2 110 MHz and 2 170 MHz for the transmitter (F_{DL_low} = 2 110 MHz and F_{DL_high} = 2 170 MHz), and between 1 920 MHz and 1 980 MHz for the receiver (F_{UL_low} = 1 920 MHz and F_{UL_high} = 1 980 MHz).
b) Based on [i.29], radio equipment in band n65 operates between 2 170 MHz and 2 200 MHz for the transmitter (F_{DL_low} = 2 170 MHz and F_{DL_high} = 2 200 MHz) and between 1 980 MHz and 2 010 MHz for the receiver (F_{UL_low} = 1 980 MHz and F_{UL_high} = 2 010 MHz) as the Complementary Ground Component (CGC) of a Mobile-satellite service by reference to the present Harmonised Standard.
NOTE 6: In Europe, according to [i.14], [i.15] and [i.16], radio equipment in band 28 operates between 703 MHz to 736 MHz for the transmitter (F_{UL_low} = 703 MHz and F_{UL_high} = 736 MHz) and between 758 MHz to 791 MHz for the receiver (F_{DL_low} = 758 MHz and F_{DL_high} = 791 MHz).
NOTE 7: In Europe according to [i.24] and [i.25], radio equipment in band 41 operates between 2 500 MHz and 2 570 MHz (F_{DL_low} = 2 500 MHz and F_{DL_high} = 2 570 MHz).

NOTE 1: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.2] is given in annex A.

Table 1-1A: Sub-bands for band 46

E-UTRA Band
46a
46b
46c
NOTE: The sub-bands 46a and 46b are restricted to indoor use only.

Table 1-2: E-UTRA UE Intra-band contiguous CA operating bands

E-UTRA CA Band
CA_1
CA_3
CA_7
CA_38
CA_40
CA_41
CA_42

Table 1-3: E-UTRA UE Inter-band CA operating bands (two bands)

E-UTRA CA Band
CA_1-3
CA_1-7
CA_1-8
CA_1-20
CA_1-41
CA_1-42
CA_1-46
CA_3-7
CA_3-8
CA_3-20
CA_3-28
CA_3-41
CA_3-42
CA_3-46
CA_7-20
CA_7-28
CA_7-46
CA_8-20
CA_8-40
CA_8-41
CA_20-32
CA_41-42
CA_41-46
CA_42-46
CA_20-67

Table 1-4: E-UTRA UE Inter-band CA operating bands (three bands)

E-UTRA CA Band
CA_1-3-8
CA_1-3-20
CA_1-7-20
CA_3-7-20
CA_3-41-42

Table 1-5: Intra-band non-contiguous CA operating bands (with two sub-blocks)

E-UTRA CA Band
CA_3-3
CA_7-7
CA 41-41
CA_42-42

E-UTRA NB-IoT is designed to operate in the E-UTRA operating bands 1, 3, 8, 20, 28 and 65 defined in table 1-1. The present document covers requirements for E-UTRA FDD and E-UTRA TDD User Equipment from 3GPP™ Releases 8, 9, 10, 11, 12, and 13 defined in ETSI TS 136 101 [3]. This includes the requirements for E-UTRA UE operating bands and E-UTRA CA operating bands from 3GPP™ Release 13 defined in ETSI TS 136 101 [3].

NOTE 2: For Band 20:

- For user equipment designed to be mobile or nomadic, the requirements in the present document measured at the antenna port also show conformity to the corresponding requirement defined as Total Radiated Power (TRP), as described in Commission Decision 2010/267/EU [i.6] and ECC Decision (09)03 [i.7].
- For user equipment designed to be fixed or installed, the present document does not address the requirements described in Commission Decision 2010/267/EU [i.6] and ECC Decision (09)03 [i.7].

The present document contains requirements to demonstrate that radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 136 521-1 (V17.7.0) (07-2023): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing (3GPP TS 36.521-1 version 17.7.0 Release 17)".

[2] ETSI TS 136 508 (V17.6.0) (07-2023): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing (3GPP TS 36.508 version 17.6.0 Release 17)".

[3] ETSI TS 136 101 (V13.25.0) (07-2023): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 13.25.0 Release 13)".

[4] IEC 60068-2-1:2007 ED 6.0: "Environmental testing - Part 2-1: Tests - Test A: Cold".

[5] IEC 60068-2-2:2007 ED 5.0: "Environmental testing - Part 2-2: Tests - Test B: Dry heat".

[6] ETSI TS 137 544 (V16.3.0) (05-2024): "Universal Mobile Telecommunications System (UMTS); LTE; Universal Terrestrial Radio Access (UTRA) and Evolved UTRA (E-UTRA); User Equipment (UE) Over The Air (OTA) performance; Conformance testing (3GPP TS 37.544 version 16.3.0 Release 16)".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.3] ETSI EG 203 336 (V1.2.1) (05-2020): "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

[i.4] Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".

[i.5] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[i.6] Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.

[i.7] ECC Decision (09)03 of 30 October 2009 on harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz.

[i.8] Void.

[i.9] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.10] ETSI TS 136 509 (V10.3.0) (09-2014): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Special conformance testing functions for User Equipment (UE) (3GPP TS 36.509 version 10.3.0 Release 10)".

[i.11] Void.

[i.12] ETSI EN 301 908-1 (V13.1.1): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 1: Introduction and common requirements".

[i.13] ETSI TR 125 914 (V15.0.1) (09-2018): "Universal Mobile Telecommunications System (UMTS); Measurements of radio performances for UMTS terminals in speech mode (3GPP TR 25.914 version 15.0.1 Release 15)".

[i.14] Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

[i.15] ECC Decision (15)01: "Harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink)", Approved 06 March 2015.

[i.16] ECC Decision (19)02: "Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz and 450-470 MHz", approved 8 March 2019.

[i.17] Commission Implementing Decision (EU) 2018/661 of 26 April 2018 amending Implementing Decision (EU) 2015/750 on the harmonisation of the 1452-1492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union as regards its extension in the harmonised 1427-1452 MHz and 1492-1517 MHz frequency bands.

[i.18] ECC Decision (13)03: "The harmonised use of the frequency band 1 452-1 492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)".

[i.19] Commission Implementing Decision (EU) 2022/173 of 7 February 2022 on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing electronic communications services in the Union and repealing Decision 2009/766/EC.

[i.20] ECC Decision (06)13: "Designation of the bands 880-915 MHz, 925-960 MHz, 1710-1785 MHz and 1805-1880 MHz for terrestrial UMTS, LTE, WiMAX and IoT cellular systems", Approved 01 December 2006, Amended 8 March 2019.

[i.21] Commission Implementing Decision (EU) 2020/667 of 6 May 2020 amending Decision 2012/688/EU as regards an update of relevant technical conditions applicable to the frequency bands 1 920-1 980 MHz and 2 110-2 170 MHz.

[i.22] ECC Decision (06)01: The harmonised utilisation of the bands1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems, Approved 24 March 2006, Amended 8 March 2019. .

[i.23] ECC Decision (14)02: "Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks (MFCN)", Approved 27 June 2014.

[i.24] Commission Implementing Decision (EU) 2020/636 of 8 May 2020 amending Decision 2008/477/EC as regards an update of relevant technical conditions applicable to the 2 500-2 690 MHz frequency band.

[i.25] ECC Decision (05)05: "Harmonised utilization of spectrum for Mobile/Fixed Communications Networks (MFCN) operating within the band 2500-2690 MHz", Approved 18 March 2005, Amended 05 July 2019.

[i.26] Commission implementing Decision (EU) 2019/235 of 24 January 2019 on amending Decision 2008/411/EC as regards an update of relevant technical conditions applicable to the 3 400-3 800 MHz frequency band.

[i.27] ECC Decision (11)06: "Harmonised frequency arrangements and least restrictive technical conditions (LRTC) for mobile/fixed communications networks (MFCN) operating in the band 3400-3800 MHz" Approved 09 December 2011, Amended 26 October 2018.

[i.28] ECC Decision (06)09: "Designation of the bands 1980-2010 MHz and 2170-2200 MHz for use by systems in the Mobile-Satellite Service including those supplemented by a Complementary Ground Component (CGC)", Approved 01 December 2006, Amended 05 September 2007.

[i.29] Commission Implementing Decision (EU) 2022/179 of 8 February 2022 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks and repealing Decision 2005/513/EC.

[i.30] ECC Decision (04)08: "On the harmonised use of the 5 GHz frequency bands for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)". Approved 09 July 2004, latest amended 1 July 2022.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

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

aggregated Transmission Bandwidth Configuration: 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: set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements

carrier aggregation bandwidth class: class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE

Table 3.1-1: CA bandwidth classes and corresponding nominal guard bands

CA Bandwidth Class	Aggregated Transmission Bandwidth Configuration	Number of contiguous CC	Nominal Guard Band BW_{GB}
A	$N_{RB,agg} \leq 100$	1	$a_1 BW_{Channel(1)} - 0,5\Delta f_1$ (note 2)
B	$N_{RB,agg} \leq 100$	2	$0,05\ max(BW_{Channel(1)}, BW_{Channel(2)}) - 0,5\Delta f_1$
C	$100 < N_{RB,agg} \leq 200$	2	$0,05\ max(BW_{Channel(1)}, BW_{Channel(2)}) - 0,5\Delta f_1$
NOTE 1: $BW_{Channel(j)}$, j = 1, 2, 3, is the channel bandwidth of an E-UTRA component carrier according to ETSI TS 136 521-1 [1], table 5.4.2-1 and $\Delta f_1 = \Delta f$ for the downlink with Δf the subcarrier spacing while $\Delta f_1 = 0$ for the uplink.			
NOTE 2: $a_1 = 0,16/1,4$ for $BW_{Channel(1)} = 1,4$ MHz whereas $a_1 = 0,05$ for all other channel bandwidths.			

carrier aggregation configuration: combination of CA operating band(s) and CA bandwidth class(es) supported by a UE

channel bandwidth: RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell

NOTE 1: The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

NOTE 2: Channel Bandwidth and Transmission Bandwidth Configuration for one E UTRA carrier are described in figure 3.1-1.

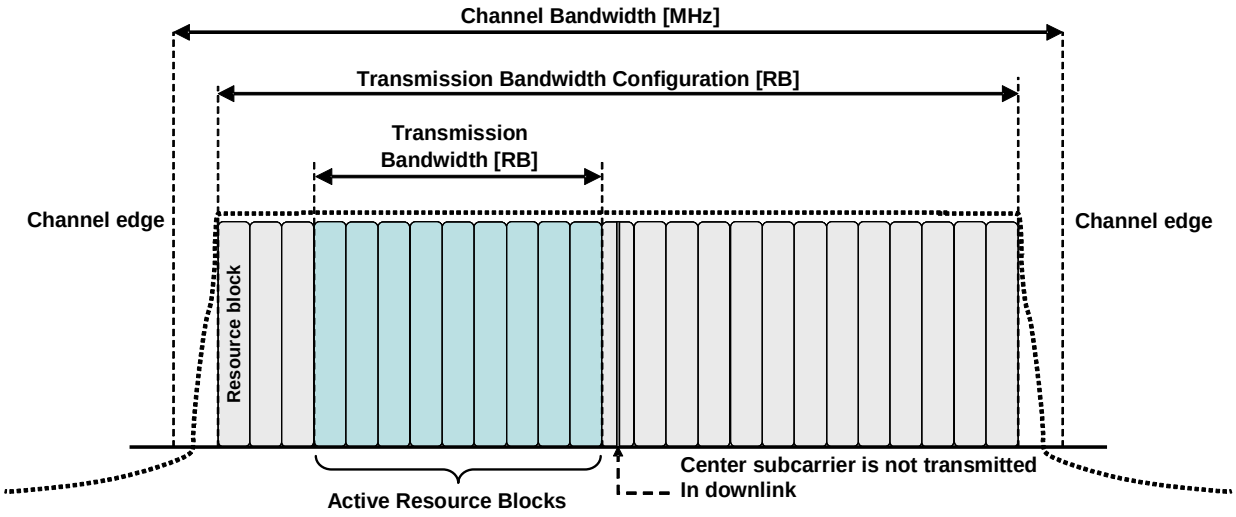

Figure 3.1-1: Channel Bandwidth and Transmission Bandwidth Configuration for one E-UTRA carrier

channel bandwidth for carrier aggregation: RF bandwidth aggregated from more than one E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of different cells

NOTE 1: Aggregated channel bandwidth and aggregated channel bandwidth edges for more than one E-UTRA carrier are described in figure 3.1-2 as in ETSI TS 136 101 [3].

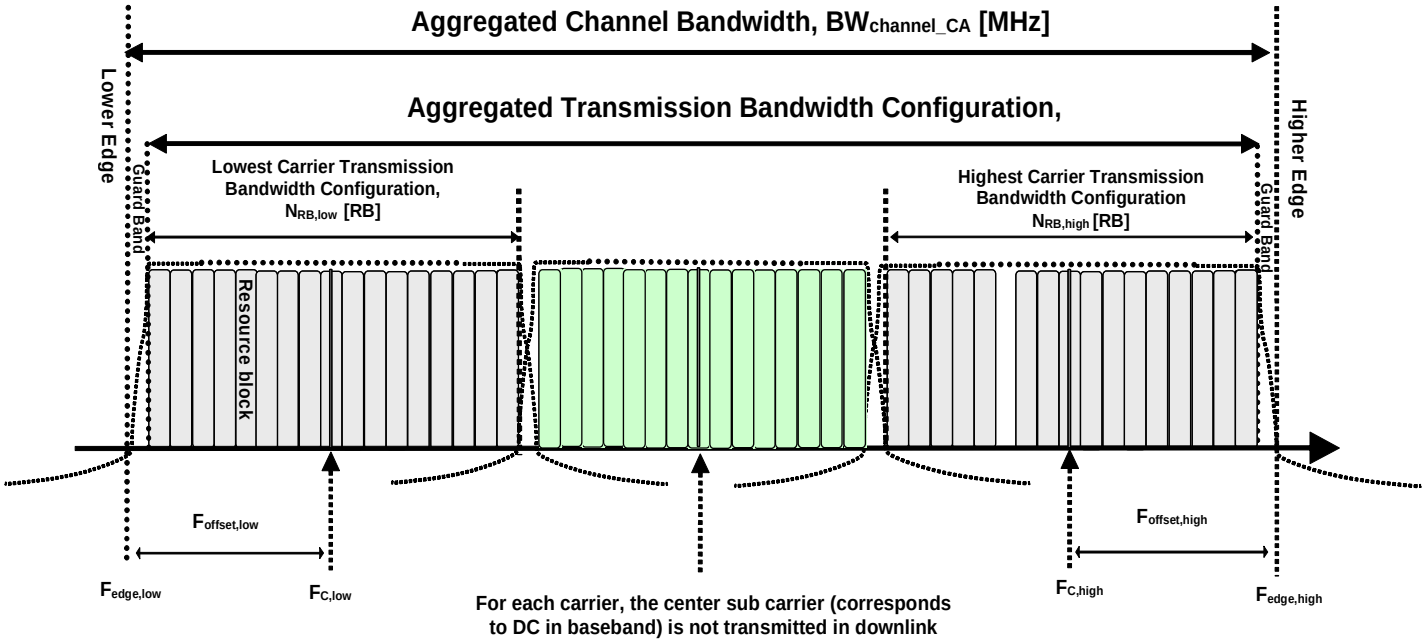

Figure 3.1-2: Aggregated channel bandwidth and aggregated channel bandwidth edges for more than one E-UTRA carrier

Figure 3.1-3 shows the relation between the category NB1 channel bandwidth ($BW_{Channel}$) and the category NB1 transmission bandwidth configuration (N_{tone}). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at $F_C \pm BW_{Channel} / 2$.

NOTE 2: Channel bandwidth and transmission bandwidth for category NB1 are described in figure 3.1-3 as in ETSI TS 136 101 [3].

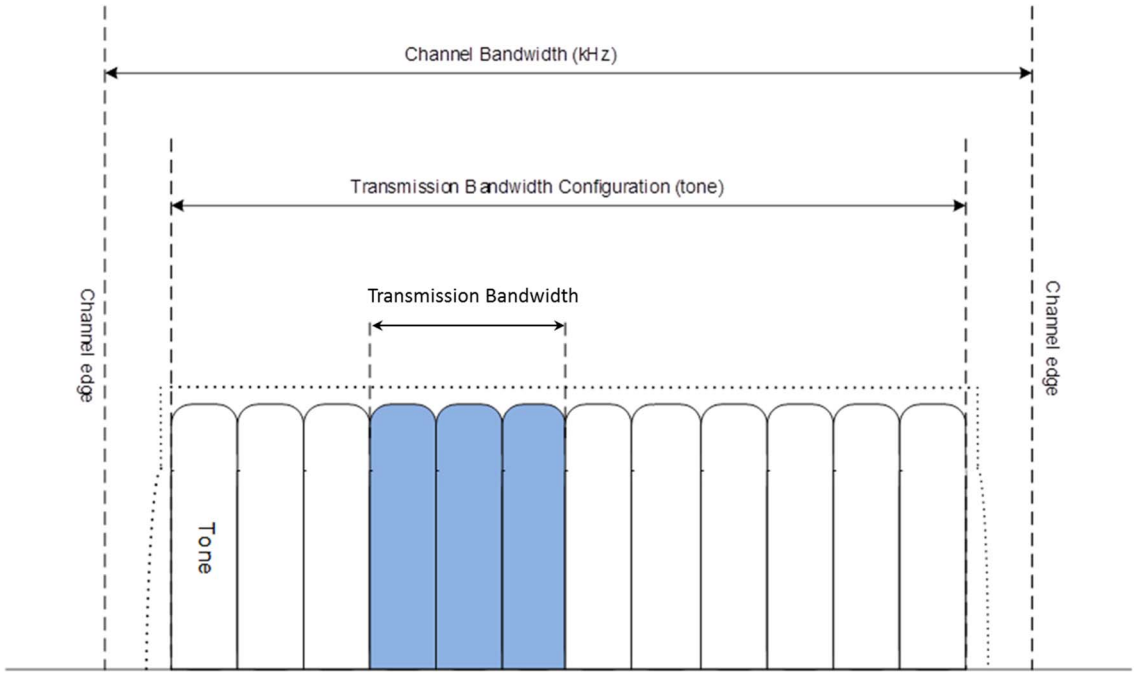

Figure 3.1-3: Definition of Channel Bandwidth and Transmission Bandwidth configuration for category NB1

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

contiguous carriers: 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

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

Maximum Output Power (MOP): mean power level per carrier of UE measured at the antenna connector in a specified reference condition

mean power: power measured in the operating system bandwidth of the carrier when applied to E-UTRA transmissions

NOTE: The period of measurement is assumed to be at least one subframe (1 ms) unless otherwise stated.

network signalled value: signalling value sent from the BS to the UE to indicate additional unwanted emission requirements to the UE

occupied bandwidth: width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission

operating band: frequency range (paired or unpaired) that is defined with a specific set of technical requirements, in which E-UTRA operates

NOTE: Operating bands for E-UTRA are designated with Arabic numerals, while the corresponding operating bands for UTRA are designated with Roman numerals.

output power: mean power of one carrier of the UE, delivered to a load with resistance equal to the nominal load impedance of the transmitter

reference bandwidth: bandwidth in which an emission level is specified

resource block: physical resource consisting of a number of symbols in the time domain and a number of consecutive subcarriers spanning 180 kHz in the frequency domain

sub-block: one contiguous allocated block of spectrum for transmission and reception by the same UE, in which there may be multiple instances of sub-blocks within an RF bandwidth

transmission bandwidth: bandwidth of an instantaneous transmission from a UE or BS, measured in Resource Block units

NOTE: See figure 3.1-1.

transmission bandwidth configuration: highest transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units

NOTE: See figure 3.1-1.

transmit diversity: transmit diversity is based on space-frequency block coding techniques complemented with frequency-shift time diversity when four transmit antennas are used

3.2 Symbols

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

Δf_{OOB}	Δ Frequency of out-of-band emission
$BW_{Channel}$	Channel bandwidth
$BW_{Channel\_CA}$	Aggregated channel bandwidth, expressed in MHz
BW_{GB}	Virtual guard band to facilitate transmitter (receiver) filtering above/below edge CCs

$BW_{Interferer}$	Channel Bandwidth of the interferer
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 received energy per RE during the useful part of the symbol, i.e. excluding the cyclic prefix, averaged across the allocated RB(s) (average power within the allocated RB(s)), divided by the number of RE within this allocation and normalized to the subcarrier spacing) at the UE antenna connector
BW_{UTRA}	Channel Bandwidth UTRA
F	Frequency
$F_{Interferer}$ (offset)	Frequency offset of the interferer
$F_{Interferer}$	Frequency of the interferer
$F_{Ioffset}$	Frequency offset of the interferer
F_C	Frequency of the carrier centre frequency
F_{CA_low}	The centre frequency of the *lowest carrier*, expressed in MHz
F_{CA_high}	The centre frequency of the *highest carrier*, expressed in MHz
F_{DL_low}	The lowest frequency of the downlink operating band
F_{DL_high}	The highest frequency of the downlink operating band
F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
F_{edge_low}	The *lower edge* of aggregated channel bandwidth, expressed in MHz
F_{edge_high}	The *higher edge* of aggregated channel bandwidth, expressed in MHz
$F_{offset\_NS\_23}$	Frequency offset in MHz needed if NS_23 is used
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 normalized to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal or the power spectral density of the total input signal at the UE antenna connector (power averaged over the useful part of the symbols within a given bandwidth and normalized to the said bandwidth), including the own-cell downlink signal
I_{or}	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 normalized 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 normalized 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_{CRB}	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks
N_{oc}	The power spectral density of a white noise source (average power per RE normalized to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector
N_{oc1}	The power spectral density of a white noise source (average power per RE normalized to the subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that are not defined in a test procedure, as measured at the UE antenna connector
N_{oc2}	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 normalized 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
$N_{Offs-DL}$	Offset used for calculating downlink EARFCN
$N_{Offs-UL}$	Offset used for calculating uplink EARFCN
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{RB_agg}	Aggregated Transmission Bandwidth Configuration The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth
N_{tone}	Transmission bandwidth configuration for category NB1, expressed in units of tones
$N_{tone\ 3,75\ kHz}$	Transmission bandwidth configuration for category NB1 with 3,75 kHz sub-carrier spacing, expressed in units of tones
$N_{tone\ 15\ kHz}$	Transmission bandwidth configuration for category NB1 with 15 kHz sub-carrier spacing, expressed in units of tones
N_{UL}	Uplink EARFCN
NS_x	Network signalled value "x"
P	Number of cell-specific antenna ports
p	Antenna port number
$P_{Interferer}$	Modulated mean power of the interferer
P_{UMAX}	Maximum UE Power with possible power reduction due to modulation type, network signalling values and location near the edge of the band
R_{av}	Minimum average throughput per RB

3.3 Abbreviations

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

AC	Access Channel
ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
BER	Bit Error Rate
BB-PPDR	Broadband Public Protection and Disaster Relief
BS	Base Station
BW	BandWidth
CA	Carrier Aggregation
CA_NS	Network Signalled value in Carrier Aggregation
CA_X	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
CA_XZ	CA for band X with bandwidth class Z where X is the applicable E-UTRA operating band and Z is the bandwidth class
CC	Component Carrier
CE	Coverage Enhancement
CP	Control Plane
CW	Continuous Wave
DCI	Downlink Control Information
DL	DownLink
DL CA	Downlink Carrier Aggregation
DTT	Digital Terrestrial Television
DUT	Device Under Test
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EFTA	European Free Trade Association
EIS	Effective Isotropic Sensitivity
ERM	Electromagnetic compatibility and Radio spectrum Matters
EUT	Equipment Under Test
EUTRA	Evolved UMTS Terrestrial Radio Access
E-UTRA	Evolved UMTS Terrestrial Radio Access
FDD	Frequency Division Duplex
GMSK	Gaussian Minimum-Shift Keying

GSM	Global System for Mobile
HARQ	Hybrid Acknowledge Request
HD-FDD	Half- Duplex FDD
IMT	International Mobile Telecommunications
LTE	Long Term Evolution
LTE-A	LTE-Advanced
MAC	Medium Access Control
MBW	Measurement BandWidth
MCC	Mobile Country Code
MOP	Maximum Output Power
MPDCCH	Machine-Type-Communications Physical Downlink Control Channel
MSG	Mobile Standards Group
NB	Narrowband IoT
NPDCCH	Narrowband Physical Downlink Control Channel
NPDSCH	Narrowband Physical Downlink Shared Channel
NPUSCH	Narrowband Physical Uplink Shared Channel
OCNG	OFDMA Channel Noise Generator
OOB	Out Of Band
OP	OFDMA Channel Noise Generator Pattern
OTA	Over The Air
PCC	Primary Component Carrier
PDCCH	Physical Downlink Control CHannel
PDSCH	Physical Downlink Shared Channel
PHICH	Physical Hybrid ARQ Indicator CHannel
PSD	Power Spectral Density
PUSCH	Physical Uplink Shared Channel
QPSK	Quadrature Phase Shift Keying
RB	Resource Block
RE	Resource Element
REFSENS	REFerence SENSitivity power level
RF	Radio Frequency
RMC	Reference Measurement Channel
RNTI	Radio Network Temporary Identifier
RRC	Root Raised Cosine
Rx	Receiver
SCC	Secondary Component Carrier
SS	System Simulator
TDD	Time Division Duplex
TFES	Task Force for European Standards for IMT
TH	Temperature High
TH/VH	High extreme Temperature/High extreme Voltage
TH/VL	High extreme Temperature/Low extreme Voltage
TL	Temperature Low
TL/VH	Low extreme Temperature/High extreme Voltage
TL/VL	Low extreme Temperature/Low extreme Voltage
TPC	Transmitter Power Control
TRP	Total Radiated Power
TRS	Total Radiated Sensitivity
Tx	Transmitter
UE	User Equipment
UL	Uplink
UL-MIMO	Uplink Multiple Antenna transmission
UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
VH	Higher extreme Voltage
VL	Lower extreme Voltage

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 Conformance requirements

4.2.0 General

The requirements in the present document are based on the assumption that the operating band (see tables 1-1 through 1-5) is shared between systems of the IMT family (for bands 3 and 8 also GSM) or systems having compatible characteristics.

4.2.1 Introduction

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.9] for IMT User Equipment (UE), a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.12] have been identified. Table 4.2.1-1 provides a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 4.2.1-1: Cross references

Essential parameter	Corresponding technical requirements	Corresponding test suite
Transmitter spectrum mask	4.2.3 Transmitter Spectrum emissions mask	5.3.2
Transmitter unwanted emissions in the out-of-band domain	4.2.11 Transmitter adjacent channel leakage power ratio	5.3.10
Transmitter unwanted emissions in the spurious domain	4.2.4 Transmitter spurious emissions	5.3.3
Transmitter power limits	4.2.2 Transmitter maximum output power	5.3.1
Transmitter Power Control (TPC)	4.2.5 Transmitter minimum output power	5.3.4
Transmitter power accuracy	4.2.2 Transmitter maximum output power	5.3.1
Receiver unwanted emissions in the spurious domain	4.2.10 Receiver spurious emissions	5.3.9
Receiver blocking	4.2.7 Receiver Blocking characteristics	5.3.6
Receiver desensitization		
Receiver spurious response rejection	4.2.8 Receiver spurious response	5.3.7
Receiver radio-frequency intermodulation	4.2.9 Receiver Intermodulation characteristics	5.3.8
Receiver adjacent signal selectivity	4.2.6 Receiver Adjacent Channel Selectivity (ACS)	5.3.5
Receiver sensitivity	4.2.12 Receiver Reference Sensitivity Level	5.3.11
Antenna	4.2.13 Receiver Total Radiated Sensitivity (TRS)	5.3.12
	4.2.14 Total Radiated Power (TRP)	5.3.13
Equipment operating under the control of a network	ETSI EN 301 908-1 [i.12], clause 4.2.4 Control and Monitoring functions	

Unless otherwise stated, the transmitter and 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 should be assumed for each antenna port(s). A UE with integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. Over The Air (OTA) antenna characteristics are specified in terms of Receiver Total Radiated Sensitivity (TRS) and Total Radiated Power (TRP).

4.2.2 Transmitter Maximum Output Power

4.2.2.1 Transmitter maximum output power for Single Carrier

4.2.2.1.1 Definition

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth. The period of measurement shall be at least one sub-frame (1 ms).

4.2.2.1.2 Limits

The UE maximum output power shall be within the range in table 4.2.2.1.2-1.

Table 4.2.2.1.2-1: UE power classes

E-UTRA Band	Power Class 3	
	Lower Limit (dBm)	Upper Limit (dBm)
1	20,3	25,7
3	20,3 (see note)	25,7
7	20,3 (see note)	25,7
8	20,3 (see note)	25,7
20	20,3 (see note)	25,0
22	18,5	26,0
28	19,8	25,0
31	20,3	25,7
33	20,3	25,7
34	20,3	25,7
38	20,3	25,7
40	20,3	25,0
41	20.3	25.7
42	19,0	26,0
43	19,0	26,0
65	20,3	25,7
68	20,3	25,7
72	20,3	25,7
87	20,3	25,7
88	20,3	25,7
NOTE: For transmission bandwidths (ETSI TS 136 521-1 [1], clause 5) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.		

NOTE: These requirements do not take into account the maximum power reductions allowed to the UE subject to certain transmission conditions specified in ETSI TS 136 101 [3], clauses 6.2.3 and 6.2.4.

4.2.2.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.2.2 Transmitter output power for Carrier Aggregation (DL CA and UL CA)

4.2.2.2.1 Definition

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 (1 ms).

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, UE maximum output power shall be measured over all component carriers from different bands. If each band has separate antenna connectors, maximum output power is measured as the sum of maximum output power at each UE antenna connector.

4.2.2.2.2 Limits

For intra-band contiguous carrier aggregation, the maximum output power shall be within the range in table 4.2.2.2.2-1.

Table 4.2.2.2.2-1: UE power class for intra-band contiguous CA

E-UTRA CA band	Power Class 3	
	Lower Limit (dBm)	Upper Limit (dBm)
CA_1C	20,3	25,7
CA_3C	20,3 (see note 1)	25,7
CA_7C	20,3 (see note 1)	25,7
CA_8B	20,3 (see note 1)	25,7
CA_38C	20,3	25,7
CA_40C	20,3	25,0
CA_41C	20,3	25,7
CA_42C	19,3	25,7
NOTE 1: If all transmitted resource blocks (ETSI TS 136 521-1 [1], clause 5) over all component carriers are confined within F_{UL_low} and F_{UL_low} + 4 MHz or/and F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.		
NOTE 2: For intra-band contiguous carrier aggregation the maximum power requirement shall apply to the total transmitted power over all component carriers (per UE).		

NOTE: These requirements do not take into account the maximum power reductions allowed to the UE in subject to certain transmission conditions specified in ETSI TS 136 101 [3], clauses 6.2.3A and 6.2.4A.

For inter-band carrier aggregation with uplink assigned to one E-UTRA band, the requirements in clause 4.2.2.1.2 apply.

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the maximum output power is specified in table 4.2.2.2.2-2.

Table 4.2.2.2.2-2: UE Power Class for uplink inter-band CA (two bands)

E-UTRA CA Configuration	Class 3 (dBm)	
	Lower Limit (dBm)	Upper Limit (dBm)
CA_1A-3A	19,3 (see note 2)	25,7
CA_1A-5A	19,3	25,7
CA_1A-7A	19,3 (see note 2)	25,7
CA_1A-8A	19,3 (see note 2)	25,7
CA_1A-28A	19,3	25,7
CA_1A-42A	19,3	25,7
CA_3A-5A	19,3 (see note 2)	25,7
CA_3A-7A	19,3 (see note 2)	25,7
CA_3A-8A	19,3 (see note 2)	25,7
CA_3A-20A	19,3 (see note 2)	25,7
CA_7A-20A	19,3 (see note 2)	25,7
CA_7A-28A	19,3 (see note 2)	25,7
NOTE 1: Void.		
NOTE 2: [2] refers to the transmission bandwidths (figure 3.1-1 confined within FUL_low and FUL_low + 4 MHz or FUL_high – 4 MHz and FUL_high, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.		
NOTE 3: $P_{powerClass}$ is the maximum UE power specified without taking into account the tolerance.		
NOTE 4: For inter-band carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).		

4.2.2.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.2.3 Transmitter output power for UL-MIMO

4.2.2.3.1 Definition

The following UE Power Classes define the maximum output power for UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The UL-MIMO configurations are specified in table 4.2.2.3.1-1.

Table 4.2.2.3.1-1: UL-MIMO configuration in closed-loop spatial multiplexing scheme

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

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 (1 ms).

4.2.2.3.2 Limits

The UE maximum output power shall be within the range in table 4.2.2.3.2-1.

Table 4.2.2.3.2-1: UE power class for UL-MIMO in closed-loop spatial multiplexing scheme

E-UTRA Band	Power Class 3	
	Lower Limit (dBm)	Upper Limit (dBm)
1	19,3	25,7
3	19,3 (see note)	25,7
7	19,3 (see note)	25,7
8	19,3 (see note)	25,7
20	19,3 (see note)	25,0
22	17,8 (see note)	25,7
28	19,3	25,0
33	19,3	25,7
34	19,3	25,7
38	19,3	25,7
40	19,3	25,0
41	19.3	25.7
42	18,0	26,0
43	18,0	26,0
65	19,3	25,7
68	19,3	25,7
72	19.3	25.7
NOTE: For transmission bandwidths (ETSI TS 136 521-1 [1], clause 5) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.		

NOTE: These requirements do not take into account the maximum power reductions allowed to the UE subject to certain transmission conditions specified in ETSI TS 136 101 [3], clauses 6.2.3 and 6.2.4.

4.2.2.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.2.4 Transmitter output power for category NB1

4.2.2.4.1 Definition

The following UE Power Classes define the maximum output power for any transmission bandwidth within the category NB1 channel bandwidth.

For 3,75 kHz sub-carrier spacing, the maximum output power is defined as mean power of measurement which period is at least one slot (2 ms) excluding the 2 304 Ts gap when UE is not transmitting. For 15 kHz sub-carrier spacing, the maximum output power is defined as mean power of measurement which period is at least one sub-frame (1 ms).

4.2.2.4.2 Limits

The maximum output power shall be within the range in table 4.2.2.4.2-1.

Table 4.2.2.4.2-1: UE Power Class test requirement

EUTRA band	Class 3		Class 5	
	Lower Limit (dBm)	Upper Limit (dBm)	Lower Limit (dBm)	Upper Limit (dBm)
1	20,3	25,7	17,3	22,7
3	20,3	25,7	17,3	22,7
8	20,3	25,7	17,3	22,7
20	20,3	25,0	17,3	22,7
28	20,3	25,0	17,3	22,7
65	20,3	25,7	17,3	22,7
72	20,3	25,7	17,3	22,7
87	20,3	25,7	17,3	22,7
88	20,3	25,7	17,3	22,7

4.2.2.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.2.5 Transmitter output power for UE category M1

4.2.2.5.1 Definition

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 (1 ms).

4.2.2.5.2 Limits

The maximum output power shall be within the range in table 4.2.2.5.2-1.

Table 4.2.2.5.2-1: UE Power Class

EUTRA band	Class 3		Class 5	
	Lower Limit (dBm)	Upper Limit (dBm)	Lower Limit (dBm)	Upper Limit (dBm)
1	20,3	25,7	17,3	22,7
3	20,3 (see note)	25,7	17,3 (see note)	22,7
7	20,3 (see note)	25,7	17,3 (see note)	22,7
8	20,3 (see note)	25,7	17,3 (see note)	22,7
20	20,3 (see note)	25,0	17,3 (see note)	22,7
28	19,8	25,0	16,8	22,7
31	20,3	25,7	17,3	22,7
41	20,3	25,7	17,3	22,7
72	20,3	25,7	17,3	22,7
87	20,3	25,7	17,3	22,7
88	20,3	25,7	17,3	22,7

NOTE: For transmission bandwidths (ETSI TS 136 521-1 [1], clause 5) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement applies by reducing the lower limit by 1,5 dB.

4.2.2.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.3 Transmitter Spectrum Emission Mask

4.2.3.1 Transmitter spectrum emission mask for Single Carrier

4.2.3.1.1 Definition

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned E-UTRA channel bandwidth.

4.2.3.1.2 Limits

The power of any UE emission shall fulfil requirements in tables 4.2.3.1.2-1 to 4.2.3.1.2-3.

Table 4.2.3.1.2-1: General E-UTRA spectrum emission mask, E UTRA bands ≤ 3 GHz

Δf_{OOB} (MHz)	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
0 to 1	-8,5	-11,5	-13,5	-16,5	-18,5	-19,5	30 kHz
1 to 2,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
2,5 to 2,8	-23,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
2,8 to 5		-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
5 to 6		-23,5	-11,5	-11,5	-11,5	-11,5	1 MHz
6 to 10			-23,5	-11,5	-11,5	-11,5	1 MHz
10 to 15				-23,5	-11,5	-11,5	1 MHz
15 to 20					-23,5	-11,5	1 MHz
20 to 25						-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.

NOTE 2: The first and last measurement position with a 1 MHz filter for 1 MHz - 2,5 MHz offset range is at Δf_{OOB} equals to 1,5 MHz and 2,0 MHz. Similarly for other Δf_{OOB} ranges.

NOTE 3: The measurements shall be performed above the upper edge of the channel and below the lower edge of the channel.

NOTE 4: For the 2,5 MHz - 2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at Δf_{OOB} equals to 3 MHz.

Table 4.2.3.1.2-2: General E-UTRA spectrum emission mask, 3 GHz < E-UTRA bands ≤ 4,2 GHz

	Spectrum emission limit (dBm)/Channel bandwidth						
Δf_{OOB} (MHz)	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
0 to 1	-8,2	-11,2	-13,2	-16,2	-18,2	-19,2	30 kHz
1 to 2,5	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	1 MHz
2,5 to 2,8	-23,2						1 MHz
2,8 to 5							1 MHz
5 to 6		-23,2	-11,2	-11,2	-11,2	-11,2	1 MHz
6 to 10			-23,2				1 MHz
10 to 15				-23,2			1 MHz
15 to 20					-23,2		1 MHz
20 to 25						-23,2	1 MHz
NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.							
NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.							
NOTE 3: The measurements shall be performed above the upper edge of the channel and below the lower edge of the channel.							
NOTE 4: For the 2,5 MHz to 2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at Δf_{OOB} equals to 3 MHz.							

Table 4.2.3.1.2-3: Additional spectrum emission mask (network signalled value "NS_01")

E-UTRA band	Frequency range	Channel Bandwidth	Spectrum emission limit (dBm)	Measurement Bandwidth
20	863 MHz ≤ f ≤ 867 MHz	10 MHz (note 2)	-11,5	1 MHz
	867 MHz ≤ f ≤ 870 MHz	10 MHz (note 2)	-14,5	1 MHz
NOTE 1: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.				
NOTE 2: The conformance shall be assessed at test frequency 857 MHz with 50 RB allocation.				

4.2.3.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.2 of the present document.

4.2.3.2 Transmitter spectrum emission mask for Carrier Aggregation (DL CA and UL CA)

4.2.3.2.1 Definition

For intra-band contiguous carrier aggregation, the spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the aggregated channel bandwidth (table 3.1-1).

For intra-band contiguous carrier aggregation of the bandwidth class B and C, the power of any UE emission shall not exceed the levels specified in table 6.6.2.1A-0 and table 6.6.2.1A-1 in ETSI TS 136 101 [3] for the specified channel bandwidth.

4.2.3.2.2 Limits

For intra-band contiguous carrier aggregation of the bandwidth class B and C, the power of any UE emission shall not exceed the levels specified in tables 4.2.3.2.2-1 and 4.2.3.2.2-2 for the specified channel bandwidth.

Table 4.2.3.2.2-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C, E UTRA bands ≤ 3 GHz

Spectrum emission limit [dBm]/$BW_{Channel\_CA}$							
Δf_{OOB} (MHz)	**25RB+100RB (24,95 MHz)**	**50RB+75RB (24,75 MHz)**	**50RB+100RB (29,9 MHz)**	**75RB+75RB (30 MHz)**	**75RB+100RB (34,85 MHz)**	**100RB+100RB (39,8 MHz)**	**Measurement bandwidth**
±0 - 1	-20,5	-20,5	-21	-21	-22	-22,5	30 kHz
±1 - 5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
±5 - 24,75	-11,5	-11,5	-11,5	-11,5	-11,5	-11,5	1 MHz
±24,75 - 24,95	-11,5	-23,5	-11,5	-11,5	-11,5	-11,5	1 MHz
±24,95 - 29,75	-23,5	-23,5	-11,5	-11,5	-11,5	-11,5	1 MHz
±29,75 - 29,9	-23,5		-11,5	-11,5	-11,5	-11,5	1 MHz
±29,9 - 29,95	-23,5		-23,5	-11,5	-11,5	-11,5	1 MHz
±29,95 - 30			-23,5	-11,5	-11,5	-11,5	1 MHz
±30 - 34,85			-23,5	-23,5	-11,5	-11,5	1 MHz
±34,85 - 34,9			-23,5	-23,5	-23,5	-11,5	1 MHz
±34,9 - 35				-23,5	-23,5	-11,5	1 MHz
±35 - 39,8					-23,5	-11,5	1 MHz
±39,8 - 39,85					-23,5	-23,5	1 MHz
±39,85 - 44,8						-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.

NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.

NOTE 3: The measurements shall be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth.

Table 4.2.3.2.2-2: General E-UTRA CA spectrum emission mask for Bandwidth Class C, 3 GHz < E UTRA bands ≤ 4,2 GHz

Spectrum emission limit [dBm]/$BW_{Channel\_CA}$							
Δf_{OOB} (MHz)	25RB+100RB (24,95 MHz)	50RB+75RB (24,75 MHz)	50RB+100RB (29,9 MHz)	75RB+75RB (30 MHz)	75RB+100RB (34,85 MHz)	100RB+100RB (39,8 MHz)	Measurement bandwidth
±0 - 1	-20,2	-20,2	-20,7	-20,7	-21,7	-22,2	30 kHz
±1 - 5	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	1 MHz
±5 - 24,75	-11,2	-11,2	-11,2	-11,2	-11,2	-11,2	1 MHz
±24,75 - 24,95	-11,2	-23,2	-11,2	-11,2	-11,2	-11,2	1 MHz
±24,95 - 29,75	-23,2	-23,2	-11,2	-11,2	-11,2	-11,2	1 MHz
±29,75 - 29,9	-23,2		-11,2	-11,2	-11,2	-11,2	1 MHz
±29,9 - 29,95	-23,2		-23,2	-11,2	-11,2	-11,2	1 MHz
±29,95 - 30			-23,2	-11,2	-11,2	-11,2	1 MHz
±30 - 34,85			-23,2	-23,2	-11,2	-11,2	1 MHz
±34,85 - 34,9			-23,2	-23,2	-23,2	-11,2	1 MHz
±34,9 - 35				-23,2	-23,2	-11,2	1 MHz
±35 - 39,8					-23,2	-11,2	1 MHz
±39,8 - 39,85					-23,2	-23,2	1 MHz
±39,85 - 44,8						-23,2	1 MHz
NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.							
NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.							
NOTE 3: The measurements shall be performed above the upper edge of the aggregated channel bandwidth and below the lower edge of the aggregated channel bandwidth.							

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spectrum emission mask of the UE is defined per component carrier while both component carriers are active and the requirements are specified in clause 4.2.3.1.2. If for some frequency spectrum emission masks of component carriers overlap, then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency a component carrier spectrum emission mask overlaps with the channel bandwidth of another component carrier, then the emission mask does not apply for that frequency.

4.2.3.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.2 of the present document.

4.2.3.3 Transmitter spectrum emission mask for UL-MIMO

4.2.3.3.1 Definition

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.

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the edge of the assigned E-UTRA channel bandwidth.

4.2.3.3.2 Limits

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in clause 4.2.3.1.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in table 4.2.2.3.1-1.

4.2.3.3.3 Conformance

Conformance tests described in clause 5.3.2 shall be carried out.

4.2.3.4 Transmitter spectrum emission mask for Multi-Cluster PUSCH within a component carrier

4.2.3.4.1 Definition

For UE supporting multi cluster PUSCH within a component carrier for the operating band.

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the edge of the assigned E-UTRA channel bandwidth.

4.2.3.4.2 Limits

The power of any UE emission shall fulfil the requirements specified in tables 4.2.3.1.2-1 and 4.2.3.1.2-2.

4.2.3.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.2 of the present document.

4.2.3.5 Transmitter spectrum emission mask for category NB1

4.2.3.5.1 Definition

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned E-UTRA channel bandwidth.

4.2.3.5.2 Limits

The power of any UE emission shall fulfil requirements in table 4.2.3.5.2-1.

Table 4.2.3.5.2-1: Category NB1 UE spectrum emission mask

Δf_{OOB} (kHz)	Spectrum emission limit (dBm)	Measurement bandwidth
±0	24,5	30 kHz
±100	-3,5	30 kHz
±150	-6,5	30 kHz
±300	-27,5	30 kHz
±500 - 1 700	-33,5	30 kHz

4.2.3.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.2 of the present document.

4.2.4 Transmitter Spurious Emissions

4.2.4.1 Transmitter spurious emissions for Single Carrier

4.2.4.1.1 Definition

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. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.4] and E-UTRA operating band requirement to address UE co-existence.

4.2.4.1.2 Limits

The spurious emission limits in table 4.2.4.1.2-2 apply for the frequency ranges that are more than Δf_{OOB} (MHz) from the edge of the channel bandwidth shown in table 4.2.4.1.2-1.

The measured average power of spurious emission for general requirements shall not exceed the described values in table 4.2.4.1.2-2.

The measured average power of spurious emission for E-UTRA operating band specific requirements to protected bands shall not exceed the described values in tables 4.2.4.1.2-3 to 4.2.4.1.2-6.

Table 4.2.4.1.2-1: Δf_{OOB} boundary between E-UTRA channel and spurious emission domain

Channel bandwidth	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Δf_{OOB} (MHz)	2,8	6	10	15	20	25

NOTE 1: 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 4.2.4.1.2-2: General spurious emissions limits

Frequency range	Maximum level	Measurement bandwidth	Comment
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12,75 GHz	-30 dBm	1 MHz	
12,75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	See note
NOTE: Shall apply for Band 22, 42 and Band 43.			

The additional requirements in table 4.2.4.1.2-3 apply for the frequency ranges that are more and less than Δf_{OOB} (MHz) from the edge of the channel bandwidth shown in table 4.2.4.1.2-1.

Table 4.2.4.1.2-3: Spurious emission band UE co-existence limits (network signalled value "NS_01")

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
1	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 38, 40, 41,42, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	Frequency range	1 895	-	1 915	-15,5	5	Notes 3, 8
	Frequency range	1 915	-	1 920	+1,6	5	Notes 3, 8, 42
3	E-UTRA Band 1, 7, 8, 20, 28, 31, 32, 33, 34, 38, 40, 41, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 34, 40, 42, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	Notes 3, 4
	Frequency range	2 575	-	2 595	-15,5	5	Notes 3, 4
	Frequency range	2 595		2 620	-40	1	Notes 3, 4
8	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 40, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 41	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 7	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
20	E-UTRA Band 1, 3, 7, 8, 22, 31, 32, 33, 34, 40, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 38, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	758	-	788	-50	1	
22	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 32, 33, 34, 38, 40, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	3 510	-	3 525	-40	1	Note 3
	Frequency range	3 525	-	3 590	-50	1	
28	E-UTRA Band 3, 7, 8, 20, 31, 34, 38, 41, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 32, 42, 43, 65	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	Notes 6, 19
	Frequency range	758	-	773	-32	1	Note 3
	Frequency range	773	-	803	-50	1	
	Frequency range	470	-	694	-42	8	Notes 3, 7
31	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 33, 34, 38, 40, 42, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
33	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 34, 38, 40, 42, 43, 65, 67, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	Note 9
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
34	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 38, 40, 41, 42, 43, 65, 67, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	Note 9
38	E-UTRA Band 1, 3, 8, 20, 22, 28, 31, 32, 33, 34, 40, 42, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	2 620	-	2 645	-15,5	5	Notes 3, 5
	Frequency range	2 645	-	2 690	-40	1	Notes 3, 5
40	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 34, 38, 41, 42, 43, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1 884,5	-	1915,7	-41	0,3	
	Frequency range	1 475	-	1 518	-50	1	
	Frequency range	3 300	-	4 200	-50	1	
	Frequency range	4 400	-	5 000	-50	1	Note 2
41	E-UTRA Band 1, 3, 8, 28, 34, 40, 42, 65,	FDL_low	-	FDL_high	-50	1	
	Frequency range	1 884,5		1 915,7	-41	0,3	Note 30
42	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 32, 33, 34, 38, 40, 41, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	
43	E-UTRA Band 1, 3, 7, 8, 20, 28, 31, 32, 33, 34, 38, 40, 65, 67, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
65	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 38, 40, 42, 43, 65, 68, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 5, 11, 18, 19, 21, 26, 27, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 36
	Frequency range	1 884,5	-	1 915,7	-41	0,3	Note 37
	Frequency range	1 900	-	1 915	-15,5	5	Notes 3, 8
	Frequency range	1 915	-	1 920	+1,6	5	Notes 3, 8
68	E-UTRA Band 3, 7, 8, 20, 22, 28, 31, 38, 40, 42, 43, 65, 72, 87, 88	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
72	E-UTRA Band 1, 7, 20, 22, 28, 31, 32, 33, 34, 38, 42, 43, 47, 52, 65, 68, 72, 87, 88	FDL_low	-	FDL_high	-50	1	
	E-UTRA Band 3, 8, 40	FDL_low	-	FDL_high	-50	1	Note 2
	Frequency range	470	-	694	-42	8	

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
87	E-UTRA Band 1, 3, 7, 8, 22, 28, 31, 32, 33, 34, 38, 40, 42, 43, 47, 52, 65, 68, 72	FDL_low	-	FDL_high	-50	1	
	E-UTRA Band, 20	FDL_low	-	FDL_high	-50	1	Note 2
	E-UTRA Band 87, 88	FDL_low	-	FDL_high	-50	1	Note 3
	Frequency range	470	-	694	-42	8	
88	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 33, 34, 38, 40, 42, 43, 47, 52, 65, 68, 72	FDL_low	-	FDL_high	-50	1	
	E-UTRA Band 87	FDL_low	-	FDL_high	-50	1	Note 3
	E-UTRA Band 88	FDL_low	-	FDL_high	-50	1	Note 3
	Frequency range	470	-	694	-42	8	

NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency range of the protected E-UTRA band.

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in table 4.2.4.1.2-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd or 4th harmonic spurious emissions. Due to spreading of the harmonic emission, the exception shall be 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 (2 MHz + N x L_{CRB} x 180 kHz), where N is 2, 3, 4 for the 2nd, 3rd or 4th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: These requirements shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in table 4.2.4.1.2-1 from the edge of the channel bandwidth.

NOTE 4: This requirement shall be applicable for any channel bandwidths within the range 2 500 MHz to 2 570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 560,5 MHz to 2 562,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 552 MHz to 2 560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 5: This requirement shall be applicable for any channel bandwidths within the range 2 570 MHz to 2 615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 605,5 MHz to 2 607,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 597 MHz to 2 605 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 2 615 t MHz o 2 620 MHz the requirement shall apply with the maximum output power configured to +19 dBm.

NOTE 6: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz are 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 5.4.2-1 in ETSI TS 136 521-1 [1]) for which the 3rd harmonic totally or partially overlaps the Measurement Bandwidth (MBW).

NOTE 7: This requirement shall be 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.

NOTE 8: This requirement shall be applicable for any channel bandwidths within the range 1 920 MHz to 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 MHz to 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 MHz to 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

NOTE 9: For non-synchronized TDD operation to meet these requirements some restrictions will be needed for either the operating band or protected band.

NOTES 10 to 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.

NOTES 20 to 29: N/A.

NOTE 30: This requirement applies when the E-UTRA carrier is confined within 2 545 MHz to 2 575 MHz or 2 595 MHz to 2 645 MHz and the channel bandwidth is 10 or 20 MHz

NOTES 31 to 35: N/A.

NOTE 36: This requirement is applicable for E-UTRA channel bandwidth allocated within 1 920 MHz to 1 980 MHz.

NOTE 37: Applicable when the upper edge of the channel bandwidth frequency is greater than 1 980 MHz.

NOTES 38 to 41: N/A.

NOTE 42: For category NB1 and NB2 UE when carrier centre frequency is 1 920,1 MHz, in case of single-tone uplink transmission the requirement is applicable only for sub-carrier index > 2.

NOTE 2: 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 4.2.4.1.2-4: Additional spurious emissions limits (network signalled value "NS_01")

E-UTRA band	Protected Frequency range	Maximum Level (dBm)	MBW (MHz)
20	470 MHz ≤ f ≤ 790 MHz	-65	8 MHz
NOTE: The conformance shall be assessed using the measurement position placed at the following centre frequencies: 474 MHz, 586 MHz, 690 MHz, 754 MHz, 770 MHz and 786 MHz.			

Table 4.2.4.1.2-5: Additional spurious emissions limits (network signalled value "NS_22")

E-UTRA band	Protected Frequency range (MHz)	Channel bandwidth/ Maximum Level (dBm)	MBW (MHz)
		5, 10, 15, 20 MHz	
42, 43	3 400 ≤ f ≤ 3 800	-23 (note 1)	5 MHz
		-40 (note 2)	1 MHz
NOTE 1: This requirement shall apply within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth. NOTE 2: This requirement shall apply from 3 400 MHz up to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge up to 3 800 MHz.			

Table 4.2.4.1.2-6: Additional spurious emissions limits (network signalled value "NS_23")

E-UTRA band	Protected Frequency range (MHz)	Channel bandwidth/ Maximum Level (dBm)	MBW (MHz)
		5, 10, 15, 20 MHz	
42, 43	3 400 ≤ f ≤ 3 800	-23 (note 1)	5 MHz
		-40 (note 2)	1 MHz
NOTE 1: This requirement shall apply within an offset between 5 MHz + $F_{offset\_NS\_23}$ and 25 + $F_{offset\_NS\_23}$ MHz from the lower and from the upper edge of the channel bandwidth. NOTE 2: This requirement shall apply from 3 400 MHz up to 25 + $F_{offset\_NS\_23}$ MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge up to 3 800 MHz. NOTE 3: $F_{offset\_NS\_23}$ is: 0 MHz for 5 MHz channel BW; 5 MHz for 10 MHz channel BW; 9 MHz for 15 MHz channel BW; and 12 MHz for 20 MHz channel BW.			

Table 4.2.4.1.2-7: Additional spurious emissions limits (network signalled value "NS_36")

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz and 15 MHz	
470 ≤ f ≤ 694	-42	8 MHz
NOTE: For a 5 MHz E-UTRA carrier confined within 698 MHz and 703 MHz, this requirement shall be met in normal conditions only. The requirement in extreme conditions is -30 dBm.		

4.2.4.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3 of the present document.

4.2.4.2 Transmitter spurious emissions for Carrier Aggregation (DL CA and UL CA)

4.2.4.2.1 Definition

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. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.4] 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 shall be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

4.2.4.2.2 Limits

NOTE 1: 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 Δf_{OOB} (MHz) in table 4.2.4.2.2-1 from the ± edge of the aggregated channel bandwidth. For frequencies Δf_{OOB} greater than f_{OOB} as specified in table 4.2.4.2.2-1 the spurious requirements in table 4.2.4.2.2-2 are applicable.

For frequencies Δf_{OOB} greater than f_{OOB} as specified in table 4.2.4.2.2-1 the measured average power of spurious emission for general requirements, shall not exceed the described values in table 4.2.4.2.2-2.

Table 4.2.4.2.2-1: Boundary between E-UTRA Δf_{OOB} and spurious emission domain for intra-band contiguous CA

CA Bandwidth Class	OOB boundary f_{OOB} (MHz)
A	table 4.2.4.1.2-1
B	$BW_{Channel\_CA}$ + 5
C	$BW_{Channel\_CA}$ + 5

Table 4.2.4.2.2-2: General spurious emissions limits for intra-band contiguous CA

Frequency Range	Maximum Level	Measurement Bandwidth	Comment
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1 000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 12,75 GHz	-30 dBm	1 MHz	
12,75 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	See note
NOTE: Shall apply for Band 22, 42 and Band 43.			

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spurious emission limit in table 4.2.4.2.2-2 applies for the frequency ranges that are more than f_{OOB} as defined in table 4.2.4.1.2-1 away from edges of the assigned channel bandwidth on a component carrier. If for some frequency a spurious emission limit of individual component carrier overlaps with the spectrum emission mask or channel bandwidth of another component carrier then it does not apply.

NOTE 2: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the limits in table 4.2.4.2.2-2 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the limits for remaining applicable frequencies in table 4.2.4.2.2-2 would be considered to be verified by the measurements verifying the one uplink inter-band CA spurious emission limit.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the spurious emission limit is defined as follows. For the E-UTRA band supporting one component carrier, the limits in table 4.2.4.2.2-2 apply for frequency ranges that are more than f_{OOB} (MHz) from the edges of assigned channel bandwidth as defined in table 4.2.4.1.2-1. For the E-UTRA band supporting two contiguous component carriers, the limits in table 4.2.4.2.2-2 apply for frequency ranges that are more than f_{OOB} (MHz) from the edges of assigned aggregated channel bandwidth as defined in table 4.2.4.2.2-1. If for some frequency a spurious emission limit of a single component carrier or two contiguous component carriers overlap with the spurious emission limit or channel bandwidth of another component carrier or two contiguously aggregated carriers then it does not apply.

For the specified intra-band contiguous CA configurations for co-existence with protected bands, the measured average power of spurious emission, shall not exceed the described value in table 4.2.4.2.2-3.

Table 4.2.4.2.2-3: Spurious emission band UE co-existence limits for intra-band contiguous CA (network signalled value "NS_01")

E-UTRA CA Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
CA_1C	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 38, 40, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_3C	E-UTRA Band 1, 7, 8, 20, 28, 32, 33, 34, 38, 40, 41, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
CA_8B	E-UTRA Band 1, 20, 28, 32, 33, 34, 38, 40	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 7	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 8	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
CA_7C	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 34, 40, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_38C	E-UTRA Band 1, 3, 8, 20, 28, 33, 34, 40, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_40C	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 34, 38, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_41C	E-UTRA Band 1, 3, 8, 28, 34, 40, 42, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
CA_42C	E-UTRA Band 1, 3, 7, 8, 20, 28, 32 33, 34, 38, 40, 41	F_{DL_low}	-	F_{DL_high}	-50	1	

NOTE 1: F_{DL_low} and F_{DL_high} refer to each E-UTRA frequency band specified in table 5.2-1, in ETSI TS 136 521-1 [1].

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in table 4.2.4.1.2-2 shall be permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd or 4th harmonic spurious emissions. An exception is allowed if there is at least one individual RE within the transmission bandwidth (see figure 5.4.2-1 in ETSI TS 136 521-1 [1]) for which the 2nd, 3rd or 4th harmonic, i.e. the frequency equal to two or three times the frequency of that RE, is within the Measurement Bandwidth (MBW).

NOTE 3: The requirement shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in tables 4.2.4.1.2-1 and 4.2.4.2.2-1 from the edge of the aggregated channel bandwidth.

For inter-band carrier aggregation with the uplink assigned to two E-UTRA bands, the limits in table 4.2.4.2.2-3A apply on each component carrier with all component carriers are active.

NOTE 3: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the requirements in table 4.2.4.2.2-3A could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the limits for remaining applicable frequencies in table 4.2.4.2.2-3A would be considered to be verified by the measurements verifying the one uplink inter-band CA UE to UE co-existence limits.

Table 4.2.4.2.2-3A: Spurious emission band UE co-existence limits for uplink inter-band CA (two bands)

E-UTRA CA Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
CA_1A-3A	E-UTRA Band 1, 7, 8, 20, 28, 32, 38, 40, 41, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	1 880		1 895	-40	1	Notes 3, 7
	Frequency range	1 895		1 915	-15,5	5	Notes 3, 7, 8
	Frequency range	1 915		1 920	+1,6	5	Notes 3, 7, 8
CA_1A-7A	E-UTRA Band 1, 7, 8, 20, 28, 32, 40, 42, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	Frequency range	1 880		1 895	-40	1	Notes 3, 7
	Frequency range	1 895		1 915	-15,5	5	Notes 3, 7, 8
	Frequency range	1 915		1 920	+1,6	5	Notes 3, 7, 8
	Frequency range	2 570	-	2 575	+1,6	5	Notes 3, 8, 9
	Frequency range	2 575	-	2 595	-15,5	5	Notes 3, 8, 9
	Frequency range	2 595	-	2 620	-40	1	Notes 3, 9
CA_1A-8A	E-UTRA Band 1, 20, 28, 32, 38, 40, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Notes 2, 3
	E-UTRA Band 7, 22, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 8, 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	Frequency range	860	-	890	-40	1	Notes 3, 6
	Frequency range	1 880		1 895	-40	1	Notes 3, 7
	Frequency range	1 895		1 915	-15,5	5	Notes 3, 7, 8
	Frequency range	1 915		1 920	+1,6	5	Notes 3, 7, 8
CA_1A-28A	E-UTRA Band 7, 8, 20, 32, 38, 40, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 22, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	Notes 4, 5
	Frequency range	470	-	694	-42	8	Notes 3, 11
	Frequency range	470	-	710	-26,2	6	Note 12
	Frequency range	758	-	773	-32	1	Note 3
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26,2	6	Note 3
	Frequency range	1 880		1 895	-40	1	Notes 3, 7
	Frequency range	1 895		1 915	-15,5	5	Notes 3, 7, 8
	Frequency range	1 915		1 920	+1,6	5	Notes 3, 7, 8
	Frequency range	1 839,9	-	1 879,9	-50	1	Note 3
CA_1A-42A	E-UTRA Band 1, 7, 8, 20, 22, 28, 32, 38, 40, 41, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	Frequency range	1 880		1 895	-40	1	Notes 3, 7
	Frequency range	1 895		1 915	-15,5	5	Notes 3, 7, 8
	Frequency range	1 915		1 920	+1,6	5	Notes 3, 7, 8
	Frequency range	1 839,9	-	1 879,9	-50	1	Note 3

E-UTRA CA Configuration	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
CA_3A-7A	E-UTRA Band 1, 7, 8, 20, 28, 32, 33, 34, 40, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	2 570	-	2 575	+1,6	5	Notes 3, 8, 9
	Frequency range	2 575	-	2 595	-15,5	5	Notes 3, 8, 9
	Frequency range	2 595	-	2 620	-40	1	Notes 3, 9
CA_3A-8A	E-UTRA Band 1, 20, 28, 32, 33, 34, 38, 40, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 8	F_{DL_low}	-	F_{DL_high}	-50	1	Notes 2, 3
	E-UTRA Band 7, 22, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	860	-	890	-40	1	Notes 3, 6,10
CA_3A-20A	E-UTRA Band 1, 7, 8, 32, 33, 34, 40, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 3, 20	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 22, 38, 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	758	-	788	-50	1	
CA_7A-20A	E-UTRA Band 1,3, 7, 8, 22, 28, 32, 33, 34, 40, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F_{DL_high}	-50	1	Note 3
	E-UTRA Band 42	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	Frequency range	2 570	-	2 575	+1,6	5	Notes 3, 8, 9
	Frequency range	2 575	-	2 595	-15,5	5	Notes 3, 8, 9
	Frequency range	2 595	-	2 620	-40	1	Notes 3, 9
CA_7A-28A	E-UTRA Band 3, 5, 7, 8, 20, 34, 40, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1, 22, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	Note 2
	E-UTRA Band 1	F_{DL_low}	-	F_{DL_high}	-50	1	Notes 4, 5
	Frequency range	758	-	773	-32	1	Note 3
	Frequency range	773	-	803	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	Notes 3, 8, 9
	Frequency range	2 575	-	2 595	-15,5	5	Notes 3, 8, 9
	Frequency range	2 595	-	2 620	-40	1	Notes 3, 9

NOTE 1: F_{DL_low} and F_{DL_high} refer to each E-UTRA frequency band specified in table 1-1.

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in table 4.2.4.1.2-1 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. In case the exceptions are allowed 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 (2 MHz + N x L_{CRB} x 180 kHz), where N is 2, 3 or 4 for the 2nd, 3rd or 4th harmonic respectively. The exception is allowed if the Measurement Bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: These requirements also apply for the frequency ranges that are less than f_{OOB} (MHz) in table 4.2.4.1.2-1 and table 4.2.4.2.2-1 from the edge of the aggregated channel bandwidth.

NOTE 4: 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 5: 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 3.1-1) for which the 3rd harmonic totally or partially overlaps the Measurement Bandwidth (MBW).

NOTE 6: This requirement is applicable only for the following cases:

- for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 902,5 MHz ≤ F_c < 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_c) is within the range 907,5 MHz ≤ F_c ≤ 912,5 MHz without any restriction on uplink transmission bandwidth;
- for carriers of 10 MHz channel bandwidth when carrier centre frequency (F_c) is F_c = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with RB_{start} > 3.

E-UTRA CA Configuration	Spurious emission				
	Protected band	Frequency range (MHz)	Maximum Level (dBm)	MBW (MHz)	Note
NOTE 7: This requirement is applicable for any channel bandwidths within the range 1 920 MHz to 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 MHz to 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 MHz to 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 8: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band. NOTE 9: This requirement is applicable for any channel bandwidths within the range 2 500 MHz to 2 570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 560,5 MHz to 2 562,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 552 MHz to 2 560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 10: This requirement is applicable only when Band 3 transmission frequency is less than or equal to 1 765 MHz. NOTE 11: 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. NOTE 12: This requirement is applicable for 5 MHz and 10 MHz E-UTRA channel bandwidth allocated within 718 MHz to 728 MHz. 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.				

Table 4.2.4.2.2-4: Additional Spurious emission band UE co-existence limits for intra-band contiguous CA (network signalled value "CA_NS_02")

E-UTRA CA Configuration	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
CA_1C	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	See note
	Frequency range	1 900	-	1 915	-15,5	5	See note
	Frequency range	1 915	-	1 920	+1,6	5	See note
NOTE: The requirement shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in tables 4.2.4.1.2-1 and 4.2.4.2.2-1 from the edge of the aggregated channel bandwidth.							

Table 4.2.4.2.2-5: Additional Spurious emission band UE co-existence limits for intra-band contiguous CA (network signalled value "CA_NS_05")

E-UTRA CA Configuration	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
CA_38C	Frequency range	2 620	-	2 645	-15,5	5	Notes 1, 2
	Frequency range	2 645	-	2 690	-40	1	Notes 1, 2
NOTE 1: This requirement shall be applicable for carriers with aggregated channel bandwidths are confined in 2 570 MHz to 2 615 MHz. For assigned carriers with bandwidths overlapping the frequency range 2 615 MHz to 2 620 MHz the requirements apply with the maximum output power configured to +19 dBm. NOTE 2: The requirement shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in tables 4.2.4.1.2-1 and 4.2.4.2.2-1 from the edge of the aggregated channel bandwidth.							

Table 4.2.4.2.2-6: Additional Spurious emission band UE co-existence limits for intra-band contiguous CA (network signalled value "CA_NS_06")

E-UTRA CA Configuration	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
CA_7C	Frequency range	2 570	-	2 575	+1,6	5	See note
	Frequency range	2 575	-	2 595	-15,5	5	See note
	Frequency range	2 595	-	2 620	-40	1	See note
NOTE: The requirement shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in tables 4.2.4.1.2-1 and 4.2.4.2.2-1 from the edge of the aggregated channel bandwidth.							

Table 4.2.4.2.2-7: Additional Spurious emission band UE co-existence limits for intra-band contiguous CA (network signalled value "CA_NS_08")

E-UTRA CA Configuration	Protected band	Frequency band (MHz)	Channel bandwidth/Spectrum emission limit (dBm)	MBW
			5, 10, 15, 20 MHz	
CA_42C	42, 43	3 400 ≤ f ≤ 3 800	-23 (note 1)	5 MHz
			-40 (note 2)	1 MHz
NOTE 1: This requirement shall apply within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth. NOTE 2: This requirement shall apply from 3 400 MHz up to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge up to 3 800 MHz.				

4.2.4.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.1 of the present document.

4.2.4.3 Transmitter spurious emissions for UL-MIMO

4.2.4.3.1 Definition

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.

4.2.4.3.2 Limits

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in clause 4.2.4.1.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in table 4.2.2.3.1-1.

For single-antenna port scheme, the general requirements in clause 4.2.4.1.2 apply.

4.2.4.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3 of the present document.

4.2.4.4 Transmitter spurious emissions for Multi-Cluster PUSCH within a component carrier

4.2.4.4.1 Definition

For UE supporting multi cluster PUSCH within a component carrier for the operating band.

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.

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 shall be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

4.2.4.4.2 Limits

The spurious emission limits in table 4.2.4.1.2-2 apply for the frequency ranges that are more than Δf_{OOB} (MHz) from the edge of the channel bandwidth shown in table 4.2.4.1.2-1.

The measured average power of spurious emission for general requirements shall not exceed the described values in table 4.2.4.1.2-2.

4.2.4.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3 of the present document.

4.2.4.5 Transmitter spurious emissions for category NB1

4.2.4.5.1 Definition

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. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.4] 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.

4.2.4.5.2 Limits

When UE is configured for category NB1 uplink transmissions the requirements in clause 4.2.4.1.2 apply with an exception that boundary between category NB1 out of band and spurious domain shall be f_{OOB} = 1,7 MHz.

4.2.4.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.3 of the present document.

4.2.5 Transmitter Minimum Output Power

4.2.5.1 Transmitter minimum output power for Single Carrier

4.2.5.1.1 Definition

The minimum 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.

4.2.5.1.2 Limits

The minimum output power measured shall not exceed the values specified in table 4.2.5.1.2-1.

Table 4.2.5.1.2-1: Minimum output power

	Channel bandwidth/minimum output power/measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
Minimum output power	For carrier frequency f ≤ 3,0 GHz: ≤ -39 dBm For carrier frequency 3,0 GHz < f ≤ 4,2 GHz: ≤ -38,7 dBm					
Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

4.2.5.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.4 of the present document.

4.2.5.2 Transmitter minimum output power for Carrier Aggregation (DL CA and UL CA)

4.2.5.2.1 Definition

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous carrier aggregation, the minimum 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 is set to a minimum value.

4.2.5.2.2 Limits

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the minimum output power is defined per carrier and the limit is specified in clause 4.2.5.1.2.

For intra-band contiguous carrier aggregation, the minimum output power is defined as the mean power in one sub-frame (1 ms). The minimum output power shall not exceed the values specified in table 4.2.5.2.2-1.

Table 4.2.5.2.2-1: Minimum output power for intra-band contiguous CA UE

	CC Channel bandwidth/Minimum output power/Measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
Minimum output power	For carrier frequency f ≤ 3,0 GHz: ≤ -39 dBm For carrier frequency 3,0 GHz < f ≤ 4,2 GHz: ≤ -38,7 dBm					
Measurement bandwidth	-	-	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

4.2.5.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.4 of the present document.

4.2.5.3 Transmitter minimum output power for UL-MIMO

4.2.5.3.1 Definition

For UE supporting UL-MIMO, the minimum 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.

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 UE antenna connector in one sub-frame (1 ms).

4.2.5.3.2 Limits

The minimum sum of mean output power of the UE at each antenna connector measured shall not exceed the values specified in table 4.2.5.3.2-1.

Table 4.2.5.3.2-1: Minimum output power for UL-MIMO

	Channel bandwidth/Minimum output power/Measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
Minimum output power	For carrier frequency f ≤ 3,0 GHz: ≤ -39 dBm For carrier frequency 3,0 GHz < f ≤ 4,2 GHz: ≤ -38,7 dBm					
Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

4.2.5.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.4 of the present document.

4.2.5.4 Transmitter minimum output power for category NB1

4.2.5.4.1 Definition

For category NB1 UE the single-tone and multi-tone transmission minimum output power requirement for the channel bandwidth is -40 dBm.

For 3,75 kHz sub-carrier spacing the minimum output power is defined as mean power in one slot (2 ms) excluding the 2 304Ts gap when UE is not transmitting. For 15 kHz sub-carrier spacing the minimum output power is defined as mean power in one sub-frame (1 ms).

4.2.5.4.2 Limits

The minimum output power measured shall not exceed the value of -40 dBm for the channel bandwidth of category NB1 UE.

4.2.5.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.4 of the present document.

4.2.6 Receiver Adjacent Channel Selectivity (ACS)

4.2.6.1 Receiver Adjacent Channel Selectivity (ACS) for Single Carrier

4.2.6.1.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an 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).

4.2.6.1.2 Limits

The throughput R_{av} shall be $\geq$ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1] under the conditions specified in table 4.2.6.1.2-2 and also under the conditions specified in table 4.2.6.1.2-3.

Table 4.2.6.1.2-1: Adjacent channel selectivity

		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

Table 4.2.6.1.2-2: Test parameters for Adjacent channel selectivity, Case 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	REFSENS + 14 dB					
$P_{Interferer}$	dBm	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +42,5 dB	REFSENS +39,5 dB
$BW_{Interferer}$	MHz	1,4	3	5	5	5	5
$F_{Interferer}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} or $P_{CMAX\_L\_CA}$ as defined in clause 6.2.5 in ETSI TS 136 101 [3].							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].							
NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in ETSI TS 136 521-1 [1], tables 7.3EA-1 and 7.3EA-2 should be used as REFSENS for the power in Transmission Bandwidth Configuration and $P_{Interferer}$.							
NOTE 5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.							

Table 4.2.6.1.2-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units	Channel bandwidth					
		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
$P_{Interferer}$	dBm	-25					
$BW_{Interferer}$	MHz	1,4	3	5	5	5	5
$F_{Interferer}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 24 dB below P_{CMAX_L} or $P_{CMAX\_L\_CA}$ as defined in clause 6.2.5 in ETSI TS 136 101 [3].							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							

4.2.6.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.5.1 of the present document.

4.2.6.2 Receiver Adjacent Channel Selectivity (ACS) for Carrier Aggregation in DL-only bands

4.2.6.2.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an 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).

4.2.6.2.2 Limits

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 clause 4.2.6.1.2 for each component carrier while both downlink carriers are active, or the requirement specified in table 4.2.6.2.2-1 with the test parameters specified in table 4.2.6.2.2-2 and table 4.2.6.2.2-3 for operating band 46. For E-UTRA CA configurations including an operating band without uplink band (as noted in table 1-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation.

Table 4.2.6.2.2-1: Adjacent channel selectivity for Band 46

E-UTRA band	Rx Parameter	Units	Channel bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46	ACS	dB	-	-	-	-	-	27

Table 4.2.6.2.2-2: Test parameters for Adjacent channel selectivity for Band 46, Case 1

E-UTRA Band	Rx Parameter	Units	Channel bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46	Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB					
	$P_{Interferer}$	dBm	-	-	-	-	-	REFSENS +39,5 dB
	$BW_{Interferer}$	MHz	-	-	-	-	-	20
	$F_{Interferer}$ (offset)	MHz	-	-	-	-	-	20 + 0,0025 / -20 - 0,0025
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.3-2 with P_{CMAX_L} as defined in clause 6.2.5).								
NOTE 2: The interferer shall consist of the Reference measurement channel specified in table A3.2-2c of ETSI TS 136 521-1 [1] with one sided dynamic OCNG Pattern OP.1 -F33 as described in clause A.5.4.1 of ETSI TS 136 521-1 [1] and set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].								

Table 4.2.6.2.2-3: Test parameters for Adjacent channel selectivity for Band 46, Case 2

E-UTRA band	Rx Parameter	Units	Channel bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46	Power in Transmission Bandwidth Configuration	dBm	-	-	-	-	-	-50,5
	$P_{Interferer}$	dBm	-25					
	$BW_{Interferer}$	MHz	-	-	-	-	-	20
	$F_{Interferer}$ (offset)	MHz	-	-	-	-	-	20 + 0,0025 / -20 - 0,0025
NOTE 1: The transmitter shall be set to 24 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.3-2 with P_{CMAX_L} as defined in clause 6.2.5).								
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with one sided dynamic OCNG Pattern OP.1 F33 as described in clause A.5.1 of ETSI TS 136 521-1 [1] and set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].								

4.2.6.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.5.2 of the present document.

4.2.6.3 Receiver Adjacent Channel Selectivity (ACS) for category NB1

4.2.6.3.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a 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).

4.2.6.3.2 Limits

Category NB1 UE shall fulfil the minimum requirement specified in table 4.2.6.3.2-1 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 4.2.6.3.2-1 where the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in clause A.3.2 of ETSI TS 136 521-1 [1].

Table 4.2.6.3.2-1: Test parameters for Adjacent channel selectivity, category NB1

ACS1 test Parameters		
Interferer	**GSM (GMSK)**	**E-UTRA**
Category NB1 signal power (P_{wanted}) / dBm	REFSENS + 14 dB	
interferer signal power ($P_{Interferer}$) / dBm	REFSENS + 42 dB	REFSENS + 47 dB
Interferer bandwidth	200 kHz	5 MHz
Interferer offset from category NB1 channel edge	±200 kHz	±2,5 MHz
ACS2 test Parameters		
Interferer	**GSM (GMSK)**	**E-UTRA**
Category NB1 signal power (P_{wanted}) / dBm	-53 dBm	-58 dBm
interferer signal power ($P_{Interferer}$) / dBm	-25 dBm	
Interferer bandwidth	200 kHz	5 MHz
Interferer offset from category NB1 channel edge	±200 kHz	±2,5 MHz

4.2.6.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.5.3 of the present document.

4.2.7 Receiver Blocking Characteristics

4.2.7.1 Receiver Blocking Characteristics for Single Carrier

4.2.7.1.1 Definition

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 occurs.

4.2.7.1.2 Limits

With parameters specified in tables 4.2.7.1.2-1 and 4.2.7.1.2-2, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1].

With parameters specified in tables 4.2.7.1.2-3 and 4.2.7.1.2-4, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1], except for the spurious response frequencies.

For table 4.2.7.1.2-4 in frequency ranges 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 1 MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration. For these exceptions the requirements of clause 4.2.8.1 Spurious response are applicable.

With parameters specified in table 4.2.7.1.2-5, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1].

Table 4.2.7.1.2-1: In-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
$BW_{Interferer}$	MHz	1,4	3	5	5	5	5
$F_{loffset, case\ 1}$	MHz	2,1125	4,5075	7,5125	7,5025	7,5075	7,5125
$F_{loffset, case\ 2}$	MHz	3,5075	7,5075	12,5075	12,5125	12,5025	12,5075
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with a set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].							
NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in ETSI TS 136 521-1 [1], tables 7.3EA-1 and 7.3EA-2 should be used as REFSENS for the power in Transmission Bandwidth Configuration.							
NOTE 5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.							

Table 4.2.7.1.2-2: In-band blocking

E-UTRA band	Parameter	Units	Case 1	Case 2
	$P_{Interferer}$	dBm	-56	-44
	$F_{Interferer}$ (Offset)	MHz	= -BW/2 - $F_{loffset, case\ 1}$ and = +BW/2 + $F_{loffset, case\ 1}$	≤ -BW/2 - $F_{loffset, case\ 2}$ and ≥ +BW/2 + $F_{loffset, case\ 2}$
1, 3, 7, 8, 20, 22, 28, 31, 33, 34, 38, 40, 41, 42, 43, 65, 68, 72, 87, 88	$F_{Interferer}$	MHz	(note 2)	F_{DL_low} - 15 to F_{DL_high} + 15
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 - FIoffset, case 1; and b) the carrier frequency + BW/2 + FIoffset, case 1.				
NOTE 3: $F_{Interferer}$ range values for unwanted modulated interfering signal are interferer centre frequencies.				

Table 4.2.7.1.2-3: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9

NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].
NOTE 3: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].
NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in ETSI TS 136 521-1 [1], tables 7.3EA-1 and 7.3EA-2 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
NOTE 5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

Table 4.2.7.1.2-4: Out-of-band blocking

E-UTRA band	Parameter	Units	Frequency		
			Range 1	Range 2	Range 3
	$P_{Interferer}$	dBm	-44	-30	-15
1, 3, 7, 8, 20, 22, 28, 31, 33, 34, 38, 40, 41, 42 (note 2), 43 (note 2), 65, 68, 72, 87, 88	$F_{Interferer}$ (CW)	MHz	F_{DL_low} - 15 to F_{DL_low} - 60	F_{DL_low} - 60 to F_{DL_low} - 85	F_{DL_low} - 85 to 1 MHz
			F_{DL_high} + 15 to F_{DL_high} + 60	F_{DL_high} + 60 to F_{DL_high} + 85	F_{DL_high} + 85 to +12 750 MHz

NOTE 1: Range 3 shall be tested only with the highest channel bandwidth.
NOTE 2: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2 800 MHz and $F_{Interferer}$ < 4 400 MHz.

Table 4.2.7.1.2-5: Narrow-band blocking

Parameter	Units	Channel Bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
P_w	dBm	$P_{REFSENS}$ + channel-bandwidth specific value below					
		22	18	16	13	14	16
P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55
F_{uw} (offset for Δf = 15 kHz)	MHz	0,9075	1,7025	2,7075	5,2125	7,7025	10,2075

NOTE 1: The transmitter shall be set a 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).
NOTE 2: Reference measurement channel is in clause A.3.2 of ETSI TS 136 521-1 [1].
NOTE 3: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].
NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in ETSI TS 136 521-1 [1], tables 7.3EA-1 and 7.3EA-2 should be used as $P_{REFSENS}$ for P_w.
NOTE 5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

4.2.7.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.6.1 of the present document.

4.2.7.2 Receiver Blocking Characteristics for Carrier Aggregation in DL-only bands

4.2.7.2.1 Definition

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 occurs.

4.2.7.2.2 Limits

With parameters specified in tables 4.2.7.1.2-1 and 4.2.7.2.2-1, or table 4.2.7.2.2-1a and table 4.2.7.2.2-1b for band combinations including operating band 46 without uplink operation, the throughput on SCC shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 for the DL-signal as described in clauses A.5.1.1, A.5.2.1 and A.5.4.1) in ETSI TS 136 521-1 [1].

With parameters specified in tables 4.2.7.1.2-3 and 4.2.7.2.2-2, or table 4.2.7.1.2-3 and table 4.2.7.2.2-2a for band combinations including operating band 46 without uplink operation, the throughput on SCC shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1], except for the spurious response frequencies.

For table 4.2.7.2.2-2 or table 4.2.7.2.2-2a 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 1 MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration. For these exceptions the requirements of clause 4.2.8.2 Spurious response are applicable.

With parameters specified in table 4.2.7.1.2-5, the throughput on SCC shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1].

Table 4.2.7.2.2-1: In-band blocking for additional operating bands for carrier aggregation

E-UTRA band	Parameter	Units	Case 1	Case 2
	$P_{Interferer}$	dBm	-56	-44
	$F_{Interferer}$ (offset)	MHz	= -BW/2 - $F_{loffset,case\ 1}$ & = +BW/2 + $F_{loffset,case\ 1}$	≤ -BW/2 - $F_{loffset,case\ 2}$ & ≥ +BW/2 + $F_{loffset,case\ 2}$
32	$F_{Interferer}$	MHz	(note 2)	F_{DL_low} - 15 to F_{DL_high} + 15
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 - $F_{loffset,\ case\ 1;}$ and b) the carrier frequency +BW/2 + $F_{loffset,\ case\ 1.}$ NOTE 3: $F_{Interferer}$ range values for unwanted modulated interfering signal are interferer centre frequencies.				

Table 4.2.7.2.2-1a: In band blocking parameters for carrier aggregation with Band 46

E-UTRA band	Rx parameter	Units	Channel bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46 (note 2)	Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
			-	-	-	-	-	9
	$BW_{Interferer}$	MHz	-	-	-	-	-	20
	$F_{loffset,\ case\ 1}$	MHz	-	-	-	-	-	30 + 0,0125
	$F_{loffset,\ case\ 2}$	MHz	-	-	-	-	-	50 + 0,0075
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5). NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in clauses A.5.1.1, A.5.2.1 and A.5.4.1 of ETSI TS 136 521-1 [1] and set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].									

Table 4.2.7.2.2-1b: In-band blocking for carrier aggregation with Band 46

E-UTRA band	Parameter	Unit	Case 1	Case 2
	$P_{Interferer}$	dBm	-50	-44
	$F_{Interferer}$ (offset)	MHz	= -BW/2 - $F_{loffset,case\ 1}$ & = +BW/2 + $F_{loffset,case\ 1}$	≤ -BW/2 - $F_{loffset,case\ 2}$ & ≥ +BW/2 + $F_{loffset,case\ 2}$
46	$F_{Interferer}$	MHz	(note 2)	F_{DL_low} - 60 to F_{DL_high} + 60
NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz or 60 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 - $F_{loffset,\ case\ 1;}$ and b. the carrier frequency + BW/2 + $F_{loffset,\ case\ 1.}$				
NOTE 3: $F_{Interferer}$ range values for unwanted modulated interfering signal are interferer centre frequencies.				

Table 4.2.7.2.2-2: Out-of-band blocking for inter-band carrier aggregation with one active uplink

Parameter	Units	Range 1	Range 2	Range 3
P_{wanted}	dBm	Table 4.2.7.1.2-3 for all component carriers		
$P_{interferer}$	dBm	-44 + $\Delta R_{IB,c}$	-30 + $\Delta R_{IB,c}$	-15 + $\Delta R_{IB,c}$
$F_{interferer}$ (CW)	MHz	-60 < f - $F_{DL\_Low(j)}$ < -15 or 15 < f - $F_{DL\_High(j)}$ < 60	-85 < f - $F_{DL\_Low(j)}$ ≤ -60 or 60 ≤ f - $F_{DL\_High(j)}$ < 85	1 ≤ f ≤ $F_{DL\_Low(1)}$ - 85 or $F_{DL\_High(j)}$ + 85 ≤ f ≤ $F_{DL\_Low(j+1)}$ - 85 or $F_{DL\_High(X)}$ + 85 ≤ f ≤ 12 750
NOTE 1: $F_{DL\_Low(j)}$ and $F_{DL\_High(j)}$ denote the respective lower and upper frequency limits of the operating band containing carrier *j*, *j* = 1,…, X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X = 2 or X = 3 for the present document).				
NOTE 2: For $F_{DL\_Low(j+1)}$ - $F_{DL\_High(j)}$ < 145 MHz and $F_{Interferer}$ in $F_{DL\_High(j)}$ < f < $F_{DL\_Low(j+1)}$, $F_{Interferer}$ can be in both Range 1 and Range 2. Then the lower of the $P_{Interferer}$ applies.				
NOTE 3: For $F_{DL\_Low(j)}$ - 15 MHz ≤ f ≤ $F_{DL\_High(j)}$ + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirements in the respective clauses 4.2.6.2.3 and 4.2.7.2.3 shall be applied for carrier *j*.				
NOTE 4: $\Delta R_{IB,c}$ according to table 7.3.3-1A of ETSI TS 136 521-1 [1] shall apply when serving cell *c* is measured.				

Table 4.2.7.2.2-2a: Out-of-band blocking for inter-band carrier aggregation with band 46

E-UTRA CA Configuration	Parameter	Unit	Range 1	Range 2	Range 3
CA_1A-46A, CA_3A-46A, CA_7A-46A, CA_42A-46A	P_{wanted}	dBm	Table 4.2.7.1.2-3 for all component carriers		
	$P_{interferer}$	dBm	$-44 + \Delta R_{IB,c}$	$-30 + \Delta R_{IB,c}$	$-15 + \Delta R_{IB,c}$ (note 5)
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_Low(j)} < -15$ with $j \le K$ or $15 < f - F_{DL\_High(j)} < 60$ with $j \le K$	$-85 < f - F_{DL\_Low(j)} \le -60$ or $60 \le f - F_{DL\_High(j)} < 85$	$1 \le f \le F_{DL\_Low(j)} - 85$ or $F_{DL\_High(j)} + 85 \le f \le 12\,750$

NOTE 1: $F_{DL\_Low(j)}$ and $F_{DL\_High(j)}$, j = 1,…,K,…N, denote the respective lower and upper frequency limits of the (non-overlapping) operating bands of the CA configuration numbered in increasing order of frequency, with N the number of bands in the band combination and K the number of bands with $F_{DL\_High} \le 3\,600$ MHz (K = 1 and N = 2 in this version of the present document).
NOTE 2: For $F_{DL\_Low(j)} - 15$ MHz $\le f \le F_{DL\_High(j)} + 15$ MHz the appropriate adjacent channel selectivity and in-band blocking requirements shall be applied for carrier j = 1.
NOTE 3: For $F_{DL\_Low(N)} - 60$ MHz $\le f \le F_{DL\_High(N)} + 60$ MHz the appropriate adjacent channel selectivity and in-band blocking requirements shall be applied for carrier N = 2.
NOTE 4: $\Delta R_{IB,c}$ according to table 7.3.1-1A of ETSI TS 136 521-1 [1] applies when serving cell c is measured.
NOTE 5: The power level ($P_{Interferer}$) for Range 3 is modified to -20 dBm for $F_{Interferer} > 4\,400$ MHz except for band combinations with Band 42 for which $P_{Interferer}$ for Range 3 is modified to -20 dBm for $F_{Interferer} > 2\,800$ MHz.

Table 4.2.7.2.2-3: Narrow-band blocking

Parameter	Unit	CA Bandwidth Class				
		B	C	D	E	F
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + CA Bandwidth Class specific value below				
		16	16[4]	16	16	16
P_{uw} (CW)	dBm	-55	-55	-55	-55	-55
F_{uw} (offset for Δf = 15 kHz)	MHz	$-F_{offset} - 0.2$ / $+F_{offset} + 0.2$	$-F_{offset} - 0.2$ / $+F_{offset} + 0.2$	$-F_{offset} - 0.2$ / $+F_{offset} + 0.2$	$-F_{offset} - 0.2$ / $+F_{offset} + 0.2$	$-F_{offset} - 0.2$ / $+F_{offset} + 0.2$
F_{uw} (offset for Δf = 7,5 kHz)	MHz					

NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} or $P_{CMAX\_L\_CA}$ as defined in clause 6.2.5A of ETSI TS 136 521-1 [1].
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 clauses A.5.1.1/A.5.2.1 of ETSI TS 136 521-1 [1].
NOTE 3: The F_{uw} (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the interferer and shall be further adjusted to $\lfloor F_{\text{interferer}}/0{,}015 + 0{,}5 \rfloor 0{,}015 + 0{,}0075$ MHz to be offset from the sub-carrier raster.
NOTE 4: The requirement is applied for the band combinations whose component carriers' BW $\ge$ 5 MHz.

For E-UTRA CA configurations with a component carrier assigned in Band 46, narrow-band blocking requirements do not apply in the presence of a narrow-band interferer in Band 46.

4.2.7.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.6.2 of the present document.

Table 4.2.7.2.3-1: Out-of-band blocking for inter-band carrier aggregation with Band 46

E-UTRA CA Configuration	Parameter	Unit	Range 1	Range 2	Range 3
CA_1A-46A, CA_2A-46A, CA_3A-46A, CA_4A-46A, CA_7A-46A, CA_41A-46A, CA_42A-46A	P_{wanted}	dBm	Table 4.2.7.1.2-3 for all component carriers		
	$P_{interferer}$	dBm	$-44 + \Delta R_{IB,c}$	$-30 + \Delta R_{IB,c}$	$-15 + \Delta R_{IB,c}$ (note 5)
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_Low(j)} < -15$ with $j \le K$ or $15 < f - F_{DL\_High(j)} < 60$ with $j \le K$	$-85 < f - F_{DL\_Low(j)} \le -60$ or $60 \le f - F_{DL\_High(j)} < 85$	$1 \le f \le F_{DL\_Low(j)} - 85$ or $F_{DL\_High(j)} + 85 \le f \le 12\,750$

NOTE 1: $F_{DL\_Low(j)}$ and $F_{DL\_High(j)}$, j = 1,…,K,…N, denote the respective lower and upper frequency limits of the (non-overlapping) operating bands of the CA configuration numbered in increasing order of frequency, with N the number of bands in the band combination and K the number of bands with $F_{DL\_High} \le 3\,600$ MHz (K = 1 and N = 2 in this version of the present document).

NOTE 2: For $F_{DL\_Low(j)} - 15\ MHz \le f \le F_{DL\_High(j)} + 15\ MHz$ the appropriate adjacent channel selectivity and in-band blocking requirements shall be applied for carrier j = 1.

NOTE 3: For $F_{DL\_Low(N)} - 60\ MHz \le f \le F_{DL\_High(N)} + 60\ MHz$ the appropriate adjacent channel selectivity and in-band blocking requirements shall be applied for carrier N = 2.

NOTE 4: $\Delta R_{IB,c}$ according to table 7.3.3-1A of ETSI TS 136 521-1 [1] shall apply when serving cell c is measured.

NOTE 5: The power level ($P_{Interferer}$) for Range 3 is modified to -20 dBm for $F_{Interferer} > 4\,400$ MHz except for band combinations with Band 42 for which $P_{Interferer}$ for Range 3 is modified to -20 dBm for $F_{Interferer} > 2\,800$ MHz.

4.2.7.3 Receiver Blocking Characteristics for category NB1

4.2.7.3.1 Definition

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 occurs.

4.2.7.3.2 Limits

With parameters specified in table 4.2.7.3.2-1, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1].

With parameters specified in table 4.2.7.3.2-2, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1], except for the spurious response frequencies.

For table 4.2.7.3.2-2 in frequency range 1, 2 and 3, up to $\max\left(24,\ 6\cdot\left\lceil N_{RB}/6\right\rceil\right)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1 MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration. For these exceptions the requirements of clause 4.2.8.3 Spurious response are applicable.

Table 4.2.7.3.2-1: In-band blocking parameters for category NB1

IBB1 test Parameters	
Category NB1 signal power (P_{wanted}) / dBm	REFSENS + 6 dB
Interferer	E-UTRA
Interferer signal power ($P_{Interferer}$) / dBm	- 56 dBm
Interferer bandwidth	5 MHz
Interferer offset from category NB1 channel edge	+7,5 MHz + 0,005 MHz and -7,5 MHz - 0,005 MHz
IBB2 test Parameters	
Category NB1 signal power (P_{wanted}) / dBm	REFSENS + 6 dB
Interferer	E-UTRA
Interferer signal power ($P_{Interferer}$) / dBm	- 44 dBm
Interferer bandwidth	5 MHz
Interferer offset range from category NB1 channel edge	From +12,5 MHz to F_{DL_high} + 15 MHz and From -12,5 MHz to F_{DL_low} - 15 MHz

Table 4.2.7.3.2-2: Out-of-band blocking parameters for category NB1 UE

Parameter	Units	Frequency		
		Range 1	Range 2	Range 3
P_{wanted}	dBm	REFSENS + 6 dB		
$P_{interferer}$ (CW)	dBm	-44	-30	-15
$F_{interferer}$ range	MHz	F_{DL_low} - 15 to F_{DL_low} - 60	F_{DL_low} - 60 to F_{DL_low} - 85	F_{DL_low} - 85 to 1 MHz
	MHz	F_{DL_high} + 15 to F_{DL_high} + 60	F_{DL_high} + 60 to F_{DL_high} + 85	F_{DL_high} + 85 to 12 750 MHz

NOTE 1: For operating bands which downlink band frequency range is between 729 MHz < 1 GHz the power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to: -18 dBm for the frequency range which is bounded by F_{DL_low} - 150 MHz of the lowest band that UE supports in frequency range 729 MHz < 1 GHz and F_{DL_high} + 150 MHz of the highest band that UE supports in frequency range 729 MHz < 1 GHz.

NOTE 2: For operating bands which downlink band frequency range is between 1 805 MHz < f < 2 200 MHz the power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to: -20 dBm for the frequency range which is bounded by F_{DL_low} - 200 MHz of the lowest band that UE supports in frequency range 1 805 MHz < f < 2 200 MHz and F_{DL_high} + 200 MHz of the highest band that UE supports in frequency range 1 805 MHz < f < 2 200 MHz.

4.2.7.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.6.3 of the present document.

4.2.8 Receiver Spurious Response

4.2.8.1 Receiver Spurious Response for Single Carrier

4.2.8.1.1 Definition

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 table 4.2.7.1.2-4 is not met.

4.2.8.1.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in tables 4.2.8.1.2-1 and 4.2.8.1.2-2.

Table 4.2.8.1.2-1: Spurious response parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).							
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].							

Table 4.2.8.1.2-2: Spurious Response

Parameter	Units	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

4.2.8.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.7.1 of the present document.

4.2.8.2 Receiver Spurious Response for Carrier Aggregation in DL-only bands

4.2.8.2.1 Definition

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 table 4.2.7.2.2-2 is not met.

4.2.8.2.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput on SCC of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in tables 4.2.8.1.2-1 and 4.2.8.1.2-2.

4.2.8.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.7.2 of the present document.

4.2.8.3 Receiver Spurious Response for category NB1

4.2.8.3.1 Definition

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 clause 4.2.7.3.2 is not met.

4.2.8.3.2 Limits

The throughput measurement derived in test procedure shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in table 4.2.8.3.2-1.

Table 4.2.8.3.2-1: Spurious response parameters for category NB1

Parameter	Unit	Level
P_{signal}	dBm	REFSENS + 6
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies
Number of spurious response frequencies		24 (in OOB range 1, 2, 3)
NOTE 1: Reference measurement channel is specified in clause A.3.2 in ETSI TS 136 521-1 [1]. NOTE 2: The REFSENS power level is specified in clause 7.3F.1.3 in ETSI TS 136 521-1 [1]. NOTE 3: OOB range 1, 2, 3 refers to table 4.2.7.3.2-2.		

4.2.8.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.7.3 of the present document.

4.2.9 Receiver Intermodulation Characteristic

4.2.9.1 Receiver Intermodulation Characteristics for Single Carrier

4.2.9.1.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receive- 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.

4.2.9.1.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in table 4.2.9.1.2-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 4.2.9.1.2-1: Test parameters for Wide band intermodulation

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		12	8	6	6	7	9
$P_{Interferer\ 1}$ (CW)	dBm	-46					
$P_{Interferer\ 2}$ (Modulated)	dBm	-46					
$BW_{Interferer\ 2}$		1,4	3	5			
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 - 2,1 / +BW/2 + 2,1	-BW/2 - 4,5 / +BW/2 + 4,5	-BW/2 - 7,5 / +BW/2 + 7,5			
$F_{Interferer\ 2}$ (Offset)	MHz	$2 \times F_{Interferer\ 1}$					

NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].
NOTE 3: The modulated interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].
The interfering modulated signal is a 5 MHz E-UTRA signal as described in annex C of ETSI TS 136 521-1 [1] for channel bandwidth ≥ 5 MHz.
NOTE 4: REFSENS as defined in clause 7.3.3 in ETSI TS 136 521-1 [1].
NOTE 5: For DL category M1 UE, the reference sensitivity for category M1 in ETSI TS 136 521-1 [1], tables 7.3EA-1 and 7.3EA-2 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
NOTE 6: For DL category M1 UE, the parameters for the applicable channel bandwidth apply, and BW refers to the corresponding channel bandwidth.

4.2.9.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.8.1 of the present document.

4.2.9.2 Receiver Intermodulation Characteristics for Carrier Aggregation in DL-only bands

4.2.9.2.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receive 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.

4.2.9.2.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput on SCC of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in table 4.2.9.1.2-1 or table 4.2.9.2.2-1 for band combinations including operating band 46 without uplink operation for the specified wanted signal mean power in the presence of two interfering signals.

Table 4.2.9.2.2-1: Test Parameters for Wide band intermodulation for carrier aggregation with band 46

E-UTRA band	Rx Parameter	Units	Channel bandwidth					
			1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
46	Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
			-	-	-	-	-	9
	$P_{Interferer\ 1}$ (CW)	dBm	-46					
	$P_{Interferer\ 2}$ (Modulated)	dBm	-46					
	$BW_{Interferer\ 2}$		-	-	-	-	-	20
	$F_{Interferer\ 1}$ (Offset)	MHz	-	-	-	-	-	-BW/2 - 30 / +BW/2 + 30
	$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$					
NOTE 1: The transmitter shall be set to 4 dB below P_{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P_{CMAX_L} as defined in clause 6.2.5).								
NOTE 2: Reference measurement channel is specified in clause A.3.2 of ETSI TS 136 521-1 [1] with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in clauses A.5.1.1, A.5.2.1 and A.5.4.1 of ETSI TS 136 521-1 [1].								
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in clauses A.5.1.1 and A.5.2.1 of ETSI TS 136 521-1 [1].								

4.2.9.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.8.2 of the present document.

4.2.9.3 Receiver Intermodulation Characteristics for category NB1

4.2.9.3.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receive- 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.

4.2.9.3.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in clauses 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 clauses A.5.1.1 and A.5.2.1) in ETSI TS 136 521-1 [1] with parameters specified in table 4.2.9.3.2-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 4.2.9.3.2-1: Test parameters for Wide band intermodulation for category NB1

Parameters for wideband intermodulation	
Category NB1 signal power	REFSENS + 12 dB
CW interferer signal power	-46 dBm
1,4 MHz E-UTRA interferer signal power	-46 dBm
CW interferer offset	±2,2 MHz
1,4 MHz E-UTRA interferer offset	±4,4 MHz

4.2.9.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.8.3 of the present document.

4.2.10 Receiver Spurious Emissions

4.2.10.1 Receiver Spurious Emissions for Single Carrier

4.2.10.1.1 Definition

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

4.2.10.1.2 Limits

The measured spurious emissions derived in clause 5.3.9 shall not exceed the maximum level specified in table 4.2.10.1.2-1.

Table 4.2.10.1.2-1: General receiver spurious emission requirements

Frequency Band	Measurement bandwidth	Maximum level	Note
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12,75 GHz	1 MHz	-47 dBm	
12,75 GHz ≤ f ≤ 5th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	Note 1
NOTE 1: Shall apply only for Band 22, 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 ETSI TS 136 101 [3], clause C.3.1.			

4.2.10.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.9 of the present document.

4.2.10.2 Receiver Spurious Emissions in DL-only bands

4.2.10.2.1 Definition

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

4.2.10.2.2 Limits

The measured spurious emissions in SCC derived in clause 5.3.9 shall not exceed the maximum level specified in table 4.2.10.2.2-1.

Table 4.2.10.2.2-1: General receiver spurious emission requirements

Frequency Band	Measurement bandwidth	Maximum level	Note
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12,75 GHz	1 MHz	-47 dBm	
12,75 GHz ≤ f ≤ 26 GHz	1 MHz	-47 dBm	3
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH_RA/RB as defined in ETSI TS 136 101 [3], clause C.3.1. NOTE 2: The requirements apply when the UE is configured for carrier aggregation but is not transmitting. NOTE 3: Applies only to Band 46.			

4.2.10.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.9 of the present document.

4.2.11 Transmitter Adjacent Channel Leakage Power Ratio

4.2.11.1 Transmitter adjacent channel leakage power ratio for Single Carrier

4.2.11.1.1 Definition

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.

E-UTRA Adjacent Channel Leakage power Ratio ($E\text{-}UTRA_{ACLR}$) 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 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 6.6.2.3.3.1-1 in ETSI TS 136 521-1 [1].

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel ($UTRA_{ACLR1}$) and the 2nd UTRA adjacent channel ($UTRA_{ACLR2}$). 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 4.2.11.1.2-2.

4.2.11.1.2 Limits

If the measured adjacent channel power is greater than -50 dBm then the measured $E\text{-}UTRA_{ACLR}$ shall be higher than the limits in table 4.2.11.1.2-1.

Table 4.2.11.1.2-1: E-UTRA UE ACLR

	Channel bandwidth/$E\text{-}UTRA_{ACLR1}$/measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
$E\text{-}UTRA_{ACLR1}$	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UE channel	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

If the measured UTRA channel power is greater than -50 dBm then the measured $UTRA_{ACLR1}$, $UTRA_{ACLR2}$ shall be higher than the limits in table 4.2.11.1.2-2.

Table 4.2.11.1.2-2: UTRA UE ACLR

	Channel bandwidth/$UTRA_{ACLR1/2}$/measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
$UTRA_{ACLR1}$	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Adjacent channel centre frequency offset (in MHz)	0,7 + $BW_{UTRA}/2$ / -0,7 - $BW_{UTRA}/2$	1,5 + $BW_{UTRA}/2$ / -1,5 - $BW_{UTRA}/2$	2,5 + $BW_{UTRA}/2$ / -2,5 - $BW_{UTRA}/2$	5 + $BW_{UTRA}/2$ / -5 - $BW_{UTRA}/2$	7,5 + $BW_{UTRA}/2$ / -7,5 - $BW_{UTRA}/2$	10 + $BW_{UTRA}/2$ / -10 - $BW_{UTRA}/2$
$UTRA_{ACLR2}$	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
Adjacent channel centre frequency offset (in MHz)	-	-	2,5 + 3 × $BW_{UTRA}/2$ / -2,5 - 3 × $BW_{UTRA}/2$	5 + 3 × $BW_{UTRA}/2$ / -5 - 3 × $BW_{UTRA}/2$	7,5 + 3 × $BW_{UTRA}/2$ / -7,5 - 3 × $BW_{UTRA}/2$	10 + 3 × $BW_{UTRA}/2$ / -10 - 3 × $BW_{UTRA}/2$
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UTRA 5 MHz channel Measurement bandwidth (see note 1)	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (see note 2)	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz
NOTE 1: Shall apply for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Shall apply for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum. NOTE 3: BW_{UTRA} for UTRA FDD shall be 5 MHz and for UTRA TDD shall be 1,6 MHz.						

4.2.11.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.10 of the present document.

4.2.11.2 Transmitter adjacent channel leakage power ratio for Carrier Aggregation (DL CA and UL CA)

4.2.11.2.1 Definition

For intra-band contiguous carrier aggregation, the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned carrier 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 ($UTRA_{ACLR1}$) and the 2nd UTRA adjacent channel ($UTRA_{ACLR2}$). 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 4.2.11.2.2-1.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier, the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is the ratio of the sum of the filtered mean powers centred on the assigned sub-block frequencies to the filtered mean power centred on an adjacent(s) UTRA channel frequency. $UTRA_{ACLR1/2}$ limits are applicable for all sub-blocks and are specified in table 4.2.11.2.2-2. $UTRA_{ACLR1}$ is required to be met in the sub-block gap when the gap bandwidth Wgap is 5 MHz $\leq$ Wgap < 15 MHz. Both $UTRA_{ACLR1}$ and $UTRA_{ACLR2}$ are required to be met in the sub-block gap when the gap bandwidth Wgap is 15 MHz $\leq$ Wgap.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned channel bandwidth on the component carrier to the filtered mean power centred on an adjacent channel frequency. The UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the requirement is specified in clause 4.2.11.1.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is defined as follows. For the E-UTRA band supporting one component carrier, the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent(s) UTRA channel frequency and the requirements specified in clause 4.2.11.1 apply. For the E-UTRA band supporting two contiguous component carriers the UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) 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 and the requirements specified in clause 4.2.11.2.2 apply.

For intra-band contiguous carrier aggregation, the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-$UTRA_{ACLR}$) 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 and adjacent aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidth specified in table 4.2.11.2.3-1.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier the E-UTRA Adjacent Channel Leakage power Ratio (E-$UTRA_{ACLR}$) is the ratio of the sum of the filtered mean powers centred on the assigned sub-block frequencies to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. In case the sub-block gap bandwidth Wgap is smaller than the sub-block bandwidth then for that sub-block no E-$UTRA_{ACLR}$ limit is set for the gap. In the case of the sub-block gab bandwidth Wgap is smaller than either of the sub-block bandwidths then no E- $UTRA_{ACLR}$ limit is set for the gap. The assigned E-UTRA sub-block power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in table 4.2.11.2.3-2. If the measured adjacent channel power is greater than -50 dBm then the E-$UTRA_{ACLR}$ shall be higher than the value specified in table 4.2.11.2.3-2.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, E-UTRA Adjacent Channel Leakage power Ratio (E-$UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned channel bandwidth on a component carrier to the filtered mean power centred on an adjacent channel frequency. The E-UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the limits are specified in clause 4.2.11.1.2.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the E-UTRA Adjacent Channel Leakage power Ratio (E-$UTRA_{ACLR}$) is defined as follows. For the E-UTRA band supporting one component carrier, the E-UTRA Adjacent Channel Leakage power Ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent channel frequency and the limit in clause 4.2.11.1.2 apply. For the E-UTRA band supporting two contiguous component carriers the E-UTRA Adjacent Channel Leakage power Ratio (E-$UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) aggregated channel bandwidth at nominal channel spacing and the limits of CA E-$UTRA_{ACLR}$ specified in clause 4.2.11.2.3 apply.

4.2.11.2.2 Limits for CA UTRA

If the measured adjacent UTRA channel power is greater than -50 dBm then the measured $UTRA_{ACLR1}$ and $UTRA_{ACLR2}$, shall be higher than the limits in table 4.2.11.2.2-1 for intra-band contiguous carrier aggregation.

Table 4.2.11.2.2-1: UTRA UE ACLR for CA

	CA bandwidth class/$UTRA_{ACLR1/2}$/measurement bandwidth
	CA bandwidth class C
$UTRA_{ACLR1}$	32,2 dB
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / 2 + BW_{UTRA}/2 / - $BW_{Channel\_CA}$ / 2 - BW_{UTRA}/2
$UTRA_{ACLR2}$	35,2 dB
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / 2 + 3 × BW_{UTRA}/2 / - $BW_{Channel\_CA}$ / 2 - 3 × BW_{UTRA}/2
CA E-UTRA channel Measurement bandwidth	$BW_{Channel\_CA}$ - 2 × BW_{GB}
UTRA 5 MHz channel Measurement bandwidth (note 1)	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (note 2)	1,28 MHz
NOTE 1: Shall apply for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Shall apply for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.	

Table 4.2.11.2.2-2: Requirements for intraband non-contiguous CA $UTRA_{ACLR1/2}$

	Channel bandwidth / $UTRA_{ACLR1/2}$ / measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
$UTRA_{ACLR1}$	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Adjacent channel centre frequency offset (in MHz)	0,7 + BW_{UTRA} / 2 / -0,7 - BW_{UTRA}/2	1,5 + BW_{UTRA} / 2 / -1,5 - BW_{UTRA}/2	2,5 + BW_{UTRA} / 2 / -2,5 - BW_{UTRA}/2	5 + BW_{UTRA} / 2 / -5 - BW_{UTRA} / 2	7,5 + BW_{UTRA} / 2 / -7,5 -BW_{UTRA} / 2	10 + BW_{UTRA} / 2 / -10 -BW_{UTRA} / 2
$UTRA_{ACLR2}$	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
Adjacent channel centre frequency offset (in MHz)	-	-	2,5 + 3 × BW_{UTRA} / 2 / -2,5 - 3 × BW_{UTRA} / 2	5 + 3 × BW_{UTRA} / 2 / -5 -3 × BW_{UTRA} / 2	7,5 + 3 × BW_{UTRA} / 2 / -7,5 -3 × BW_{UTRA} / 2	10 + 3 × BW_{UTRA} / 2 / -10 -3 × BW_{UTRA} / 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[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[2]	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz
NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum. NOTE 3: BW_{UTRA} for UTRA FDD is 5 MHz and for UTRA TDD is 1,6 MHz.						

4.2.11.2.3 Limits for CA EUTRA

If the measured adjacent E-UTRA channel power is greater than -50 dBm then the measured CA E-$UTRA_{ACLR}$, shall be higher than the limits in table 4.2.11.2.3-1.

Table 4.2.11.2.3-1: CA E-UTRA ACLR

	CA bandwidth class/CA E-UTRA$_{ACLR}$/Measurement bandwidth
	CA bandwidth class B and C
CA E-UTRA$_{ACLR}$	29,2 dB
CA E-UTRA channel Measurement bandwidth	$BW_{Channel\_CA}$ - 2 × BW_{GB}
Adjacent channel centre frequency offset (in MHz)	+ $BW_{Channel\_CA}$ / - $BW_{Channel\_CA}$

Table 4.2.11.2.3-2: Intraband non-contiguous CA E-UTRA UE ACLR

Channel bandwidth / E-UTRA$_{ACLR1}$ / measurement bandwidth						
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
E-UTRA$_{ACLR1}$	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UE channel	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

4.2.11.2.4 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.10 of the present document.

4.2.11.3 Transmitter adjacent channel leakage power ratio for UL-MIMO

4.2.11.3.1 Definition

E-UTRA ACLR (E-UTRA$_{ACLR}$) 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 at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidth specified in table 4.2.11.3.2-1.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in table 4.2.11.3.2-1 apply to each transmit antenna connector with the UL-MIMO configurations specified in table 4.2.2.3.1-1.

UTRA ACLR (UTRA$_{ACLR}$) 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 UTRA channel frequency.

UTRA ACLR is specified for both the first UTRA adjacent channel (UTRA$_{ACLR1}$) and the 2nd UTRA adjacent channel (UTRA$_{ACLR2}$). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor α= 0,22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in table 4.2.11.3.2-2.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in table 4.2.11.3.2-2 apply to each transmit antenna connector with the UL-MIMO configurations specified in table 4.2.2.3.1-1.

4.2.11.3.2 Limits

If the measured E-UTRA adjacent channel power is greater than -50 dBm then the E-UTRA$_{ACLR}$ shall be higher than the value specified in table 4.2.11.3.2-1.

Table 4.2.11.3.2-1: General requirements for E-UTRA$_{ACLR}$

	Channel bandwidth/E-UTRA$_{ACLR1}$/measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
E-UTRA$_{ACLR1}$	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UE channel	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

If the measured UTRA channel power is greater than -50 dBm then the UTRA$_{ACLR1}$ and UTRA$_{ACLR2}$ shall be higher than the value specified in table 4.2.11.3.2-2.

Table 4.2.11.3.2-2: General requirements for UTRA$_{ACLR1/2}$

	Channel bandwidth/E-UTRA$_{ACLR1/2}$/measurement bandwidth					
	1,4 MHz	**3,0 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
E-UTRA$_{ACLR1}$	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Adjacent channel centre frequency offset (in MHz)	0,7 + BW$_{UTRA}$/2 / -0,7 - BW$_{UTRA}$/2	1,5 + BW$_{UTRA}$/2 / -1,5 - BW$_{UTRA}$/2	2,5 + BW$_{UTRA}$/2 / -2,5 - BW$_{UTRA}$/2	5 + BW$_{UTRA}$/2 / -5 - BW$_{UTRA}$/2	7,5 + BW$_{UTRA}$/2 / -7,5 - BW$_{UTRA}$/2	10 + BW$_{UTRA}$/2 / -10 - BW$_{UTRA}$/2
UTRA$_{ACLR2}$	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
Adjacent channel centre frequency offset (in MHz)	-	-	2,5 + 3 × BW$_{UTRA}$/2 / -2,5 - 3 × BW$_{UTRA}$/2	5 + 3 × BW$_{UTRA}$/2 / -5 - 3 × BW$_{UTRA}$/2	7,5 + 3 × BW$_{UTRA}$/2 / -7,5 - 3 × BW$_{UTRA}$/2	10 + 3 × BW$_{UTRA}$/2 / -10 - 3 × BW$_{UTRA}$/2
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UTRA 5 MHz channel Measurement bandwidth (note 1)	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (note 2)	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz
NOTE 1: Shall apply for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Shall apply for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.						

4.2.11.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.10 of the present document.

4.2.11.4 Transmitter adjacent channel leakage power ratio for Multi-Cluster PUSCH within a component carrier

4.2.11.4.1 Definition

For UE supporting multi cluster PUSCH within a component carrier for the operating band.

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.

4.2.11.4.2 Limits

If the measured adjacent channel power is greater than -50 dBm then the measured E-UTRA$_{ACLR}$ shall be higher than the limits in table 4.2.11.1.2-1.

If the measured UTRA channel power is greater than -50 dBm then the measured UTRA$_{ACLR1}$, UTRA$_{ACLR2}$ shall be higher than the limits in table 4.2.11.1.2-1.

4.2.11.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.10 of the present document.

4.2.11.5 Transmitter adjacent channel leakage power ratio for category NB1

4.2.11.5.1 Definition

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.

4.2.11.5.2 Limits

The assigned category NB1 channel power and adjacent channel power are measured with filters and measurement bandwidths specified in table 4.2.11.5.2-1.

If the measured adjacent channel power is greater than -50 dBm then the measured GSM$_{ACLR}$ and UTRA$_{ACLR}$ shall be higher than the limits in table 4.2.11.5.2-1. GSM$_{ACLR}$ requirement is intended for protection of GSM system. UTRA$_{ACLR}$ requirement is intended for protection of UTRA and E-UTRA systems.

Table 4.2.11.5.2-1: Category NB1 UE ACLR Test requirements

	GSM$_{ACLR}$	**UTRA$_{ACLR}$**
ACLR	19,2 dB	36,2 dB
Adjacent channel centre frequency offset from category NB1 Channel edge	±200 kHz	±2,5 MHz
Adjacent channel measurement bandwidth	180 kHz	3,84 MHz
Measurement filter	Rectangular	RRC-filter α = 0,22
Category NB1 channel measurement bandwidth	180 kHz	180 kHz
Category NB1 channel Measurement filter	Rectangular	Rectangular

4.2.11.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.10 of the present document.

4.2.12 Receiver Reference Sensitivity Level

4.2.12.0 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 should be assumed for each antenna port(s).

4.2.12.1 Receiver Reference Sensitivity Level for Single Carrier

4.2.12.1.1 Definition

Reference sensitivity measures the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

4.2.12.1.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clauses 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 ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1) with parameters specified in table 4.2.12.1.2-1 and table 7.3.3-2 in ETSI TS 136 521-1 [1].

Table 4.2.12.1.2-1: Reference sensitivity QPSK $P_{REFSENS}$

Channel bandwidth							
E-UTRA Band	**1,4 MHz (dBm)**	**3 MHz (dBm)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**Duplex Mode**
1	-	-	-99,3	-96,3	-94,5	-93,3	FDD
3	-101,0	-98,0	-96,3	-93,3	-91,5	-90,3	FDD
7	-	-	-97,3	-94,3	-92,5	-91,3	FDD
8	-101,5	-98,5	-96,3	-93,3	-	-	FDD
20	-	-	-96,3	-93,3	-90,5	-89,3	FDD
22	-	-	-96,0	-93,0	-91,2	-90,0	FDD
28	-	-99,5	-97,8	-94,8	-93,0	-90,3	FDD
31	-98,3	-95,0	-92,8	-	-	-	FDD
33	-	-	-99,3	-96,3	-94,5	-93,3	TDD
34	-	-	-99,3	-96,3	-94,5	-	TDD
38	-	-	-99,3	-96,3	-94,5	-93,3	TDD
40	-	-	-99,3	-96,3	-94,5	-93,3	TDD
41			-97.3	-94.3	-92.5	-91.3	TDD
42	-	-	-98,0	-95,0	-93,2	-92,0	TDD
43	-	-	-98,0	-95,0	-93,2	-92,0	TDD
65	-103,5	-100,5	-98,8	-95,8	-94,0	-92,8	FDD
68			-97,8	-94,8	-93,0		FDD
72	-98,3	-95,0	-92,8				FDD
87	-98,3	-95,0	-92,8				FDD
88	-98,3	-95,0	-92,8				FDD
NOTE 1: The transmitter shall be set to maximum output power level (ETSI TS 136 521-1 [1], table 7.3.5-2).							
NOTE 2: The reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.							
NOTE 3: The signal power is specified per port.							

The reference receive sensitivity (REFSENS) requirement specified in table 4.2.12.1.2-1 shall be met for an uplink transmission bandwidth less than or equal to that specified in ETSI TS 136 521-1 [1], table 7.3.5-2.

4.2.12.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.11 of the present document.

4.2.12.2 Receiver Reference Sensitivity Level for Carrier Aggregation in DL-only bands

4.2.12.2.1 Definition

Reference sensitivity measures the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

4.2.12.2.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clauses A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1, A.5.2.1 and A.5.4.1) with parameters specified in table 4.2.12.2.2-1 and table 7.3A.3.5-2 of ETSI TS 136 521-1 [1].

Table 4.2.12.2.2-1: Reference sensitivity QPSK PREFSENS for inter-band Carrier Aggregation in DL-only band

		Channel bandwidth						
EUTRA CA Configuration	**E-UTRA Band**	**1,4 MHz (dBm)**	**3 MHz (dBm)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**Duplex Mode**
CA_1A-46A	1	-	-	-99,3	-96,3	-94,5	-93,3	FDD
	46	-	-	-	-	-	-88,5	TDD
CA_3A-46A	3	-	-	-96,3	-93,3	-91,5	-90,3	FDD
	46	-	-	-	-	-	-88,5	TDD
CA_7A-46A	7	-	-	-97,3	-94,3	-92,5	-91,3	FDD
	46	-	-	-	-	-	-88,5	TDD
CA_20A-32A	20	-	-	-96,3	-93,3	-	-	FDD
	32	-	-	-99,3	-96,3	-94,5	-93,3	
CA_42A-46A	42	-	-	-98	-95	-93,2	-92	TDD
	46	-	-	-	-	-	-81,5	

NOTE 1: The transmitter shall be set to maximum output power level.
NOTE 2: Reference measurement channel is in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in ETSI TS 136 521-1 [1] in clauses A.5.1.1, A.5.2.1 and A.5.4.1.
NOTE 3: The signal power is specified per port.
NOTE 4: Void.
NOTE 5: The requirement for B46 does not apply when there is at least one individual RE within the B46 downlink transmission bandwidth which falls into the reference sensitivity exclusion region as specified in table 4.2.12.2.2-2.
NOTE 6: Void.

Table 4.2.12.2.2-2 specifies the Band 46 reference measurement exclusion region for different licensed component carriers and channel bandwidth. The exclusion region is defined according to the licensed component carrier channel bandwidth. The UL configurations to be adopted for the test are specified in table 7.3.1-2 in ETSI TS 136 101 [3]. The exclusion region in table 4.2.12.2.2-2 is specified for the case of 10 MHz and 20 MHz channel bandwidth in Band 46.

Table 4.2.12.2.2-2: Band 46 Reference sensitivity measurement exclusion region in MHz

Licensed Component Carriers / E-UTRA Band / Harmonic order / Channel BW in UL					
Licensed Component Carriers	**Harmonic order**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
1	3	±15	±23	±35	±45
3	3	±15	±23	±35	±45
7[1]	2	±15	±25	±38	±50
NOTE 1: Even though UL harmonic does not fall directly into Band 46 the exclusion region still applies. NOTE 2: The centre of the exclusion region is obtained by multiplying the UL channel centre frequency by the harmonic order.					

4.2.12.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.11 of the present document.

4.2.12.3 Receiver Reference Sensitivity Level for category NB1

4.2.12.3.1 Definition

To verify the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

4.2.12.3.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clause A.3.2 2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1) with parameters specified in table 4.2.12.3.2-1.

Table 4.2.12.3.2-1: Reference sensitivity for category NB1

Operating band	REFSENS [dBm]
1, 3, 8, 20, 28, 65, 72, 87, 88	-107,5

4.2.12.3.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.11 of the present document.

4.2.12.4 Receiver Reference Sensitivity Level for UE category 0

4.2.12.4.1 Definition

Reference sensitivity measures the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

4.2.12.4.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clauses 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 ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1) with parameters specified in table 4.2.12.4.2-1 and table 4.2.12.4.2-2.

Table 4.2.12.4.2-1: Reference sensitivity for FDD and TDD UE category 0 QPSK $P_{REFSENS}$

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**
3	-98,5	-95,5	-93,8	-90,8	-89	-87,8	FDD
8	-99	-96	-93,8	-90,8			FDD
20			-93,8	-90,8	-87,5	-86,3	FDD
41			-94.8	-91.8	-90,0	-88.8	TDD
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in ETSI TS 136 521-1 [1], clause 6.2.5.							
NOTE 2: Reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.							

Table 4.2.12.4.2-2: Reference sensitivity for HD-FDD UE category 0 QPSK $P_{REFSENS}$

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**
3	-99,3	-96,3	-94,6	-91,6	-89,8	-88,6	HD-FDD
8	-99,8	-96,8	-94,6	-91,6			HD-FDD
20			-94,6	-91,6	-88,8	-87,6	HD-FDD
NOTE 1: The transmitter shall be set to P_{UMAX} as defined in ETSI TS 136 521-1 [1], clause 6.2.5.							
NOTE 2: Reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.							

The reference receive sensitivity (REFSENS) requirement specified in table 4.2.12.4.2-1 and table 4.2.12.4.2-2 shall be met for an uplink transmission bandwidth less than or equal to that specified in ETSI TS 136 101 [3], table 7.3.1E-2.

4.2.12.4.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.11.3 of the present document.

4.2.12.5 Receiver Reference Sensitivity Level for UE category M1

4.2.12.5.1 Definition

Reference sensitivity measures the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

4.2.12.5.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clauses A.2.2, A.2.3 and A.3.2 with parameters specified in table 4.2.12.5.2-1 and table 4.2.12.5.2-2.

Table 4.2.12.5.2-1: Reference sensitivity for FDD and TDD UE category M1 QPSK P_{REFSEN}

E-UTRA Band	REFSENS (dBm)	Duplex Mode
1	-101,5	FDD
3	-98,5	FDD
7	-95,5	FDD
8	-99,0	FDD
20	-99,0	FDD
28	-100,0	FDD
31	-95,8	FDD
41	-101,0	TDD
72	-95,8	FDD
87	-95,8	FDD
88	-95,8	FDD

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in ETSI TS 136 521-1 [1], clause 6.2.5EA.
NOTE 2: Reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.
NOTE 3: Void.
NOTE 4: Void.
NOTE 5: For cat M1 the same RF bandwidth applies for all applicable channel bandwidths as specified in ETSI TS 136 521-1 [1], table 5.4.2.1-1.
NOTE 6: The reference receive sensitivity shall be met for an uplink transmission bandwidth less than or equal to 6 RB except for band 31. For band 31; in the case of 3 MHz channel bandwidth 5 RB applies and the UL resource blocks shall be located at RB_{start} 9. In case of 5 MHz channel bandwidth 5 RB applies and the UL resource blocks shall be located at RB_{start} 10.
NOTE 7: 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.
NOTE 8: These REFSENS levels are applicable only to 6 RB. OCNG shall be filled to the entire channel bandwidth with the same PSD of REFSENS level in 6 RBs.

Table 4.2.12.5.2-2: Reference sensitivity for HD-FDD UE category M1 QPSK $P_{REFSENS}$

E-UTRA Band	REFSENS (dBm)	Duplex Mode
1	-102,3	HD-FDD
3	-99,3	HD-FDD
7	-100,3	HD-FDD
8	-99,8	HD-FDD
20	-99,8	HD-FDD
28	-100,8	HD-FDD
31	-96,6	HD-FDD
72	-96,6	HD-FDD
87	-96,6	HD-FDD
88	-96,6	HD-FDD

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in ETSI TS 136 521-1 [1], clause 6.2.5EA.
NOTE 2: Reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.
NOTE 3: Void.
NOTE 4: Void.
NOTE 5: For cat M1 the same RF bandwidth applies for all applicable channel bandwidths as specified in ETSI TS 136 521-1 [1], table 5.4.2-1.
NOTE 6: These REFSENS levels are applicable only to 6 RB. OCNG shall be filled to the entire channel bandwidth with the same PSD of REFSENS level in 6 RBs.

The reference receive sensitivity (REFSENS) requirement specified in table 4.2.12.5.2-1 and table 4.2.12.5.2-2 shall be met for an uplink transmission bandwidth less than or equal to that specified in ETSI TS 136 101 [3], table 7.3.1E-5.

4.2.12.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.11.4 of the present document.

4.2.13 Receiver Total Radiated Sensitivity (TRS)

4.2.13.0 Applicability

The present requirement applies to handheld phones/DUTs that are wider than or equal to 56 mm and narrower than or equal to 72 mm.

'Receiver Total Radiated Sensitivity (TRS)' requirements for devices not fitting this width criteria (e.g. devices narrower than 56 mm and wider than 72 mm) are not covered by the current version of the present document.

4.2.13.1 Definition

The Total Radiated Sensitivity is defined as:

$$TRS = \frac{4\pi}{\oint \left[\frac{1}{EIS_{\theta}(\Omega; f)} + \frac{1}{EIS_{\varphi}(\Omega; f)} \right] d\Omega}$$

Where the Effective Isotropic Sensitivity (EIS) is defined as the power available at the antenna output such as the sensitivity threshold is achieved for each polarization. Ω is the solid angle describing the direction, f is frequency. θ and φ are the orthogonal polarizations.

$$TRS \approx \frac{2NM}{\pi \sum_{n=0}^{N-1} \sum_{m=0}^{M-1} \left[\frac{1}{EIS_{\theta}(\theta_n, \varphi_m; f)} + \frac{1}{EIS_{\varphi}(\theta_n, \varphi_m; f)} \right] \sin(\theta_n)}$$

In these formulas, N and M are the number of sampling intervals for theta and phi. θ_n and φ_m are the measurement angles. The sampling intervals are discussed further in clause 4.4 of ETSI TS 137 544 [6].

The TRS can also be calculated from measurements in a Rayleigh fading 3 dimensional isotropic environment within average uniform elevation and azimuth distribution. The calculation of the TRS is in this case based on searching for the lowest power received by the UE/MS for a discrete number of field combinations in the chamber that gives a BER that is better than the specified target BER level. By calibrating the average power transfer function, an absolute value of the TRS can be obtained. The following expression can be used to find the TRS:

$$TRS \approx 2N \frac{\left(\sum_{n=1}^{N} \left(C_n (1 - R_n) P_{thres,n} \right) \right)^{-1}}{\sum_{n=1}^{N} P_{ref,n}}$$

where $P_{ref,n}$ is the reference power transfer function for fixed measurement antenna n, R_n is the reflection coefficient for fixed measurement antenna n and C_n is the path loss in the cables connecting the measurement receiver to fixed measurement antenna n. These parameters are calculated from the calibration measurement and are further discussed in clause B.2 of ETSI TS 137 544 [6]. $P_{thres,n}$ is calculated by using the following equation:

$$P_{thres,n} = \frac{\sum_{m=1}^{M} \frac{1}{\left| S_{21,n,m}^{thres} \right|^2}}{M}$$

where $S_{21,n,m}^{thres}$ is the m:th value of the transfer function for fixed measurement antenna n, which gives the BER threshold. M is the total number of values of the BER threshold power measured for each fixed measurement antenna.

4.2.13.2 Limits

The average measured Total Radiated Sensitivity (TRS) of low, mid and high channels for handheld UE shall be lower than the average TRS requirement specified in table 4.2.13.2-1. The averaging shall be done in linear scale for the TRS results of both right and left side of the phantom head. Average TRS requirement is shown in the column "Average" on the requirement tables.

$$TRS_{average} = 10\log\left[6 \Big/ \left(\frac{1}{10^{P_{left\_low}/10}} + \frac{1}{10^{P_{left\_mid}/10}} + \frac{1}{10^{P_{left\_high}/10}} + \frac{1}{10^{P_{right\_low}/10}} + \frac{1}{10^{P_{right\_mid}/10}} + \frac{1}{10^{P_{right\_high}/10}}\right)\right]$$

Table 4.2.13.2-1: TRS minimum requirements for E-UTRA FDD and TDD bands in the speech position Beside Head Hand Left and Beside Head Hand Right (BHHL/BHHR) for the primary mechanical mode

Operating band	Unit	<REFÎ$_{or}$>
		Average
1	dBm/10 MHz	-86
3	dBm/10 MHz	-86
7	dBm/10 MHz	-85,7
8	dBm/10 MHz	-82,5
20	dBm/10 MHz	-82,5
28	dBm/10 MHz	-82,5
38	dBm/20 MHz	-82,5
40	dBm/20 MHz	-82,5
NOTE: Not applicable for carrier aggregation.		

NOTE: The TRS minimum requirements are applicable for devices wider than or equal to 56 mm and narrower than or equal to 72 mm as defined in ETSI TR 125 914 [i.13].

4.2.13.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.12 of the present document.

4.2.14 Total Radiated Power (TRP)

4.2.14.0 Applicability

The present requirement applies to handheld phones/DUTs that are wider than or equal to 56 mm and narrower than or equal to 72 mm.

'Total Radiated Power (TRP)' requirements for devices not fitting this width criteria (e.g. devices narrower than 56 mm and wider than 72 mm) are not covered by the current version of the present document.

4.2.14.1 Definition

The Total Radiated Power (TRP) is a measure of how much power the DUT actually radiates. The TRP is defined as the integral of the power transmitted in different directions over the entire radiation sphere:

$$TRP = \frac{1}{4\pi}\oint\left(EIRP_{\theta}(\Omega; f) + EIRP_{\varphi}(\Omega; f)\right)d\Omega$$

Where Ω is the solid angle describing the direction, f is frequency. θ and φ are the orthogonal polarizations. $EIRP_{\theta}$ and $EIRP_{\varphi}$ are the actually transmitted power-levels in corresponding polarizations.

Thus:

$$TRP \approx \frac{\pi}{2NM} \sum_{n=0}^{N-1} \sum_{m=0}^{M-1} \left[EIRP_{\theta}(\theta_n, \varphi_m; f) + EIRP_{\varphi}(\theta_n, \varphi_m; f) \right] \sin(\theta_n)$$

In these formulas N and M are the number of sampling intervals for theta and phi. θ_n and φ_m are the measurement angles. The sampling intervals are discussed further in clause 4.4 of ETSI TS 137 544 [6].

The TRP can also be calculated from Rayleigh faded samples of the total power transmitted from the UE. The measurement of transmitter performance in an isotropic Rayleigh fading environment is based on sampling the radiated power of the UE for a discrete number of field combinations in the chamber. The average value of these statistically distributed samples is proportional to the TRP and by calibrating the average power transfer function, an absolute value of the TRP can be obtained.

Thus:

$$TRP \approx \frac{\sum_{n=1}^{N} \left(\frac{P_n}{C_n (1 - R_n)} \right)}{\sum_{n=1}^{N} P_{ref,n}}$$

where $P_{ref,n}$ is the reference power transfer function for fixed measurement antenna n, R_n is the reflection coefficient for fixed measurement antenna n and C_n is the path loss in the cables connecting the measurement receiver to fixed measurement antenna n. These parameters are calculated from the calibration measurement and are further discussed in clause B.2 of ETSI TS 137 544 [6]. P_n is the average power measured by fixed measurement antenna n and can be calculated using the following expression:

$$P_n = \frac{\sum_{m=1}^{M} \left| S_{21,n,m} \right|^2}{M}$$

where $S_{21,n,m}$ is sample number m of the complex transfer function measured with fixed measurement antenna n and M is the total number of samples measured for each fixed measurement antenna.

NOTE 1: All averaging are performed using linear power values (e.g. measurements in Watts).

NOTE 2: The requirements and this test apply to all types of UTRA for the FDD UE for Release 7 and later releases.

4.2.14.2 Limits

The average TRP of low, mid and high channels in beside head position shall be higher than minimum performance requirements for roaming bands shown in table 4.2.14.2-1. The averaging shall be done in linear scale for the TRP results of both right and left side of the phantom head.

$$TRP_{average} = 10\log\left[\frac{10^{P_{left\_low}/10} + 10^{P_{left\_mid}/10} + 10^{P_{left\_high}/10} + 10^{P_{right\_low}/10} + 10^{P_{right\_mid}/10} + 10^{P_{right\_high}/10}}{6} \right]$$

Table 4.2.14.2-1: TRP minimum performance requirement for E-UTRA FDD and TDD bands in the speech position Beside Head Hand Left and Beside Head Hand Right (BHHL/BHHR) for primary mechanical mode

Operating band	Unit	Power Class 3
		Power (dBm) Average
1	dBm/10 MHz	10,9
3	dBm/10 MHz	10,9
7	dBm/10 MHz	10,9
8	dBm/10 MHz	7,6
20	dBm/10 MHz	7,6
28	dBm/10 MHz	7,6
38	dBm/20 MHz	10,9
40	dBm/20 MHz	10,9
NOTE: Not applicable for carrier aggregation.		

NOTE: The TRP minimum requirements are applicable for devices wider than or equal to 56 mm and narrower than or equal to 72 mm as defined in ETSI TR 125 914 [i.13].

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.

Normally it should be sufficient for all tests to be conducted using normal test conditions except where otherwise stated.

Test environments are specified in annex B.

For guidance on the use of other conditions to be used in order to show compliance reference can be made to ETSI TS 136 521-1 [1], clause F.1.1.

For each operating frequency band of the UE, the tests in the present document are performed with appropriate frequencies defined in ETSI TS 136 508 [2].

5.2 Void

5.3 Essential radio test suites

5.3.0 General

This clause describes the test suites that shall be used for E-UTRA FDD and TDD.

This clause also describes the test suites that shall be used for E-UTRA half duplex FDD and full duplex FDD for UE category 0 and UE category M1.

5.3.1 Transmitter Maximum Output Power

5.3.1.1 Transmitter maximum output power for Single Carrier

5.3.1.1.1 Method of test

5.3.1.1.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.2.2.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.1.1.2 Procedure

1) Sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.2.2.1.4.1-1 of ETSI TS 136 521-1 [1]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2.

5.3.1.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.1.2 in order to show compliance.

5.3.1.2 Transmitter maximum output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

5.3.1.2.1 Method of test

5.3.1.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.2.2A.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.2.2A.1.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the mean transmitted power over all component carriers in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2A.1.

5.3.1.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.2.2 in order to show compliance.

5.3.1.2A Transmitter maximum output power for inter-band Carrier Aggregation (DL CA and UL CA)

5.3.1.2A.1 Method of test

5.3.1.2A.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range for PCC and SCC, high range for PCC and SCC; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest N_{RB_agg}, highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 6.2.2A.2.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.2A.1.2 Test procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.2.2A.2.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the mean transmitted power over all component carriers in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2A.2.

5.3.1.2A.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.2.2 in order to show compliance.

5.3.1.3 Transmitter maximum output power for UL-MIMO

5.3.1.3.1 Method of test

5.3.1.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.2.2B.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.3.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.2.2B.4.1-1 of ETSI TS 136 521-1 [1]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2B.

5.3.1.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.3.2 in order to show compliance.

5.3.1.4 Transmitter maximum output power for category NB1

5.3.1.4.1 Method of Test

5.3.1.4.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: frequency ranges as defined in ETSI TS 136 521-1 [1], clause K.1.2 as specified in ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only the main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.4.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.2.2F.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via NPDCCH DCI format N0 for C_RNTI to schedule the UL RMC according to table 6.2.2F.4.1-1 of ETSI TS 136 521-1 [1]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC (UE should be already transmitting P_{UMAX} after initial conditions setting).

2) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms) for subcarrier spacing of 15 kHz or one slot (2 ms) excluding the 2 304 Ts gap when UE is not transmitting for sub-carrier spacing of 3,75 kHz. Half-duplex guard subframes are not under test.

NOTE: For configuration IDs applicable to UE depending on UE capability in Test Configuration Table with different UL sub-carrier spacing, the SS releases the connection through State 3A-NB and finally ensures that the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the appropriate UL subcarrier spacing in Random Access Response message.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2F.

5.3.1.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.4.2 in order to show compliance.

5.3.1.5 Transmitter maximum output power for UE category 0

5.3.1.5.1 Method of test

5.3.1.5.1.1 Initial conditions

Same initial conditions as in clause 5.3.1.1.1.1 with the following exceptions:

- Instead of clause 6.2.2.4.1 in ETSI TS 136 521-1 [1] → use clause 6.2.2E.4.1 in ETSI TS 136 521-1 [1].
- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.5.1.2 Procedure

Same test procedure as in clause 5.3.1.1.1.2 with the following exception for HD-FDD:

- In step 3), slots with transient periods are not under test. Half-duplex guard subframes are not under test.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2E.

5.3.1.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.1.2 in order to show compliance.

5.3.1.6 Transmitter maximum output power for UE category M1

5.3.1.6.1 Method of test

5.3.1.6.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.2.2EA.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.1.6.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.2.2EA.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test. For HD-FDD slots with transient periods and Half-duplex guard subframe are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.2.2EA.

5.3.1.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.2.5.2 in order to show compliance.

5.3.2 Transmitter Spectrum Emission Mask

5.3.2.1 Transmitter spectrum emission mask for Single Carrier

5.3.2.1.1 Method of test

5.3.2.1.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.1.1.2 Procedure

1) SS sends uplink scheduling information via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 or 4.2.3.1.2-2 or 4.2.3.1.2-3, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1.

5.3.2.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.1.2 in order to show compliance.

5.3.2.2 Transmitter spectrum emission mask for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

5.3.2.2.1 Method of test

5.3.2.2.1.1 Initial conditions

Test environment: normal; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1A.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.2.1A.1.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.2.3.2.2-1 or 4.2.3.2.2-2, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1A.1.

5.3.2.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2.2 in order to show compliance.

5.3.2.2A Transmitter spectrum emission mask for inter-band Carrier Aggregation (DL CA and UL CA)

5.3.2.2A.1 Method of test

5.3.2.2A.1.1 Initial conditions

Test environment: normal; as specified in annex B.

Frequencies to be tested: low range for PCC and SCC, high range for PCC and SCC; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1A.2.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.2A.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.2.1A.2.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the power of the transmitted signal for PCC with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 or 4.2.3.1.2-2, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

7) Measure the power of the transmitted signal for SCC with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 or 4.2.3.1.2-2, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

8) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1A.2.

5.3.2.2A.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.1.2 in order to show compliance.

5.3.2.3 Transmitter spectrum emission mask for UL-MIMO

5.3.2.3.1 Method of test

5.3.2.3.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1B.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.3.1.2 Procedure

1) SS sends uplink scheduling information via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.1B.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 or 4.2.3.1.2-2, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1B.

5.3.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.3.2 in order to show compliance.

5.3.2.4 Transmitter spectrum emission mask for Multi-Cluster PUSCH within a component carrier

5.3.2.4.1 Method of test

5.3.2.4.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1_1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.4.1.2 Procedure

1) SS sends uplink scheduling information via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.1_1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 or 4.2.3.1.2-2, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1.1.

5.3.2.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.4.2 in order to show compliance.

5.3.2.5 Transmitter spectrum emission mask for category NB1

5.3.2.5.1 Method of test

5.3.2.5.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.1; as specified in ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.4.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1F.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.5.1.2 Procedure

1) SS sends uplink scheduling information via NPDCCH DCI format N0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.1F.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC (UE should be already transmitting P_{UMAX} after Initial Conditions setting).

2) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in ETSI TS 136 521-1 [1], table 6.2.3F.5-1. The measurement duration is at least one sub-frame **(**1 ms) for 15 kHz channel spacing, and at least a 2 ms slot (excluding the 2 304Ts gap when UE is not transmitting) respectively for the 3,75 kHz channel spacing.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 4.2.3.5.2-1, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE: For configuration IDs applicable to UE depending on UE capability in Test Configuration Table with different UL sub-carrier spacing, the SS releases the connection through State 3A-NB and finally ensures that the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the appropriate UL subcarrier spacing in Random Access Response message.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1.

5.3.2.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.5.2 in order to show compliance.

5.3.2.6 Transmitter spectrum emission mask for UE category 0

5.3.2.6.1 Method of test

5.3.2.6.1.1 Initial conditions

Same initial conditions as in clause 5.3.2.1.1.1 with following exceptions:

- Instead of clause 6.6.2.1.4.1 in ETSI TS 136 521-1 [1] → use clause 6.6.2.1E.4.1 in ETSI TS 136 521-1 [1].
- Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.6.1.2 Procedure

Same test procedure as in clause 5.3.2.1.1.2 with following exception:

- Instead of table 6.6.2.1.4.1-1 in ETSI TS 136 521-1 [1] → use table 6.6.2.1E.4.1-1 in ETSI TS 136 521-1 [1].

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1E.

5.3.2.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.1.2 in order to show compliance.

5.3.2.7 Transmitter spectrum emission mask for UE category M1

5.3.2.7.1 Method of test

5.3.2.7.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and 15 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.3 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.1EA.4.1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.2.7.1.2 Procedure

1) SS sends uplink scheduling information via PDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.1EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to tables 4.2.3.1.2-1 and 4.2.3.1.2-3, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.1EA.

5.3.2.7.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.1.2 in order to show compliance.

5.3.3 Transmitter Spurious Emissions

5.3.3.1 Transmitter spurious emissions for Single Carrier

5.3.3.1.1 Method of test

5.3.3.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3.1.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) For each applicable requirement in tables from 4.2.4.1.2-2 to 4.2.4.1.2-6; measure the power of the transmitted signal with a measurement filter of bandwidths. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3.1, 6.6.3.2 and 6.6.3.3.

5.3.3.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.1.2 in order to show compliance.

5.3.3.2 Transmitter spurious emissions for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

5.3.3.2.1 Method of test

5.3.3.2.1.1 Initial conditions

Test environment: normal; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3.1A.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.3.1A.1.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) For each applicable requirement in tables from 4.2.4.2.2-2 to 4.2.4.2.2-7; measure the power of the transmitted signal with a measurement filter of bandwidths for each component carrier. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3.1A.1 and 6.6.3.2A.1.

5.3.3.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.2.2 in order to show compliance.

5.3.3.2A Transmitter spurious emissions for inter-band Carrier Aggregation (DL CA and UL CA)

5.3.3.2A.1 Method of test

5.3.3.2A.1.1 Initial conditions

Test environment: normal; as specified in annex B.

Frequencies to be tested: low range for PCC and SCC, high range for PCC and SCC; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3.1A.2.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.2A.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.3.1A.2.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) For each applicable requirement in table 4.2.4.2.2-3A; measure the power of the transmitted signal with a measurement filter of bandwidths for each component carrier. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3.1A.2 and 6.6.3.2A.2.

5.3.3.2A.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.2.2 in order to show compliance.

5.3.3.3 Transmitter spurious emissions for UL-MIMO

5.3.3.3.1 Method of test

5.3.3.3.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3B.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.3.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.3B.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) For each applicable requirement in tables 4.2.4.1.2-2 and 4.2.4.1.2-3, measure the power of the transmitted signal with a measurement filter of bandwidths. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3B.1 and 6.6.3B.2.

5.3.3.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.3.2 in order to show compliance.

5.3.3.4 Transmitter spurious emissions for Multi-Cluster PUSCH within a component carrier

5.3.3.4.1 Method of test

5.3.3.4.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: Highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3.1_1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.3.1_1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
2) Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3) For the requirements in table 4.2.4.1.2-2, measure the power of the transmitted signal with a measurement filter of bandwidths. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.3.1.1.

5.3.3.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.4.2 in order to show compliance.

5.3.3.5 Transmitter spurious emissions for category NB1

5.3.3.5.1 Method of test

5.3.3.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: Frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.2, see ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1.1 and H.4.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.3F.1.4.1 and clause 6.6.3F.2.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.5.1.2 Procedure

1) SS sends uplink scheduling information via NPDCCH DCI format N0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.3F.1.4.1-1 or table 6.6.3F.2.4.1-1 (co-existence) and with the scheduling pattern according to ETSI TS 136 521-1 [1], clause A.2. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC (UE should be already transmitting P_{UMAX} after Initial Conditions setting).

2) For each applicable requirement in tables 4.2.4.1.2-1 and 4.2.4.1.2-2, measure the power of the transmitted signal with a measurement filter of bandwidths. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

NOTE: For configuration IDs applicable to UE depending on UE capability in Test Configuration Table with different UL sub-carrier spacing, the SS releases the connection through State 3A-NB and finally ensures that the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the appropriate UL subcarrier spacing in Random Access Response message.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3F.1 and 6.6.3F.2.

5.3.3.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.5.2 in order to show compliance.

5.3.3.6 Transmitter spurious emissions for UE category 0

5.3.3.6.1 Method of test

5.3.3.6.1.1 Initial conditions

Same initial conditions as in clause 5.3.3.1.1.1 with following exceptions for HD-FDD:

- Instead of clause 6.6.3.1.4.1 in ETSI TS 136 521-1 [1] → use clauses 6.6.3E.1.4.1 or 6.6.3E.2.4.1 in ETSI TS 136 521-1 [1], as applicable.
- Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.6.1.2 Procedure

Same test procedure as in clause 5.3.3.1.1.2 with following exception for HD-FDD:

- In step 3), slots with transient periods are not under test. Half-duplex guard subframes are not under test.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.3E.

5.3.3.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.1.2 in order to show compliance.

5.3.3.7 Transmitter spurious emissions for UE category M1

5.3.3.7.1 Method of test

5.3.3.7.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested:

- for general requirements: lowest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1; or
- for operating band specific requirements to protected bands: lowest, 5 MHz and highest channel bandwidths as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.7 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], use clauses 6.6.3EA.1.4.1 or 6.6.3EA.2.4.1, as applicable.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.3.7.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], use tables 6.6.3EA.1.4.1-1 or 6.6.3EA.2.4.1-1, as applicable. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) For each applicable requirement in tables from 4.2.4.1.2-2 to 4.2.4.1.2-4 measure the power of the transmitted signal with a measurement filter of bandwidths. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.3EA.

5.3.3.7.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.1.2 in order to show compliance.

5.3.4 Transmitter Minimum Output Power

5.3.4.1 Transmitter minimum output power for Single Carrier

5.3.4.1.1 Method of test

5.3.4.1.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth, as specified in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.3.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuous uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

3) Measure the mean power of the UE in the associated measurement bandwidth specified in table 4.2.5.1.2-1 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2.

5.3.4.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.1.2 in order to show compliance.

5.3.4.2 Transmitter minimum output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

5.3.4.2.1 Method of test

5.3.4.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2A.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.3.2A.1.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

6) Measure the mean transmitted power of each component carrier in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2A.1.

5.3.4.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.2.2 in order to show compliance.

5.3.4.2A Transmitter minimum output power for inter-band Carrier Aggregation (DL CA and UL CA)

5.3.4.2A.1 Method of test

5.3.4.2A.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range for PCC and SCC, high range for PCC and SCC; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2A.2.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.2A.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.3.2A.2.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

6) Measure the mean transmitted power of each component carrier in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2A.2.

5.3.4.2A.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.2.2 in order to show compliance.

5.3.4.3 Transmitter minimum output power for UL-MIMO

5.3.4.3.1 Method of test

5.3.4.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2B.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.3.2B.1.4.1-1 of ETSI TS 136 521-1 [1]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

3) Measure the sum of mean power of the UE at each UE antenna connector in the associated measurement bandwidth specified in table 4.2.5.3.2-1 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2B.

5.3.4.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.3.2 in order to show compliance.

5.3.4.4 Transmitter minimum output power for category NB1

5.3.4.4.1 Method of test

5.3.4.4.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.1, see ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only the main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2F.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via NPDCCH DCI format N0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.3.2F.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms) for sub-carrier spacing of 15 kHz or one slot (2 ms) excluding the 2 304Ts gap when UE is not transmitting for sub-carrier spacing of 3,75 kHz. Half-duplex guard subframes are not under test.

NOTE: For configuration IDs applicable to UE depending on UE capability in Test Configuration Table with different UL sub-carrier spacing, the SS releases the connection through State 3A-NB and finally ensures that the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the appropriate UL subcarrier spacing in Random Access Response message.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2.

5.3.4.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.4.2 in order to show compliance.

5.3.4.5 Transmitter minimum output power for UE category 0

5.3.4.5.1 Method of test

5.3.4.5.1.1 Initial conditions

Same initial conditions as in clause 5.3.4.1.1.1 with following exceptions:

- Instead of clause 6.3.2.4.1 in ETSI TS 136 521-1 [1] → use clause 6.3.2E.4.1 in ETSI TS 136 521-1 [1].
- Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.5.1.2 Procedure

Same test procedure as in clause 5.3.4.1.1.2 with the following exception for HD-FDD:

- In step 3), slots with transient periods are not under test. Half-duplex guard subframes are not under test.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2E.

5.3.4.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.1.2 in order to show compliance.

5.3.4.6 Transmitter minimum output power for UE category M1

5.3.4.6.1 Method of test

5.3.4.6.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: 5 MHz channel bandwidth, as specified in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.3.2EA.4.1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.4.6.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.3.2EA.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuous uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

3) Measure the mean power of the UE in the associated measurement bandwidth specified in table 4.2.5.1.2-1 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test. For HD-FDD slots with transient periods and Half-duplex guard subframe are not under test.

4) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2EA.

5.3.4.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.5.1.2 in order to show compliance.

5.3.5 Receiver Adjacent Channel Selectivity (ACS)

5.3.5.1 Receiver Adjacent Channel Selectivity (ACS) for Single Carrier

5.3.5.1.1 Method of test

5.3.5.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS and interfering source to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.5.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.5.1.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.5.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in table 4.2.6.1.2-2 (Case 1). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-2 (Case 1) for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4,2$ GHz, for at least the duration of the Throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [1], table 7.5.3-2).

4) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-2 (Case 1) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex D.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Set the Downlink signal level to the value as defined in table 4.2.6.1.2-3 (Case 2). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-3 (Case 2) for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4,2$ GHz, for at least the duration of the throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [1], table 7.5.3-3.

7) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-3 (Case 2) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex D.

8) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], annex G.

9) Repeat for applicable channel bandwidths in both Case 1 and Case 2.

10) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5.

5.3.5.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.6.1.2 in order to show compliance.

5.3.5.2 Receiver Adjacent Channel Selectivity (ACS) for Carrier Aggregation in DL-only bands

5.3.5.2.1 Method of test

5.3.5.2.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: Highest N_{RB_agg} for PCC and SCC.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS and interfering source to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.5A.3.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.5.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 for all downlink physical channels.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.5A.3.4.1-1 on PCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6) Set the Downlink signal level for PCC and SCC to the value as defined in table 4.2.6.1.2-2 (Case 1), or table 4.2.6.2.2-2 for operating band 46. Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-2 (Case 1) for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the Throughput measurement.

7) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-2 (Case 1), or table 4.2.6.2.2-2 for operating band 46, and frequency below the wanted signal, using a modulated interferer bandwidth as defined in ETSI TS 136 521-1 [1], annex D.

8) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

9) Repeat steps from 6 to 8, using an interfering signal above the wanted signal in Case 1 at step 7).

10) Set the Downlink signal level for PCC and SCC to the value as defined in table 4.2.6.1.2-3 (Case 2), or table 4.2.6.2.2-3 for operating band 46. Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-3 (Case 2) for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the Throughput measurement.

11) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-3 (Case 2), or table 4.2.6.2.2-3 for operating band 46, and frequency below the wanted signal, using a modulated interferer bandwidth as defined in ETSI TS 136 521-1 [1], annex D.

12) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

13) Repeat steps from 10 to 12, using an interfering signal above the wanted signal in Case 2 at step 11).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5.

5.3.5.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.6.2.2 in order to show compliance.

5.3.5.3 Receiver Adjacent Channel Selectivity (ACS) for category NB1

5.3.5.3.1 Method of test

5.3.5.3.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: Frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.1, see ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only the main UE Tx/Rx antenna, and noting that the interference can be either GSM or E-UTRA.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.2 and NPUSCH Format 2 is used to carry ACK/NACK on the uplink.

4) The DL Reference Measurement channel is set according to ETSI TS 136 521-1 [1], table 7.5F.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5. Message contents are defined according to ETSI TS 136 521-1 [1], clause 7.5F.4.3.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.5.3.1.2 Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

2) Set the Downlink signal level to the value defined for ACS1, GSM in table 4.2.6.3.2-1.

3) Set the Interferer signal level to the value defined for ACS1, GSM in table 4.2.6.3.2-1, with frequency below the wanted signal according to table 4.2.6.3.2-1, using a modulated interferer bandwidth as defined in ETSI TS 136 521-1 [1], clause D.2.

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Repeat steps 2) to 4), using an interfering signal above the wanted signal at step 3).

6) Set the Downlink signal level to the value defined for ACS1, E-UTRA in table 4.2.6.3.2-1.

7) Set the Interferer signal level to the value defined for ACS1, E-UTRA in table 4.2.6.3.2-1, with frequency below the wanted signal according to table 4.2.6.3.2-1, using a modulated interferer bandwidth as defined in ETSI TS 136 521-1 [1], clause D.2.

8) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

9) Repeat steps 6) to 8), using an interfering signal above the wanted signal at step 7).

10) Release the connection through State 3A-NB.

11) Modify system information elements according to ETSI TS 136 521-1 [1], table 7.5F.4.3-1 and notify the UE via paging message with SytemInformationModification included.

12) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the new UL power control setting.

13) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

14) Set the Downlink signal level to the value defined for ACS2, GSM in table 4.2.6.3.2-1. For steps 14 to 17 and 18 to 21, use message contents with the exceptions defined in ETSI TS 136 521-1 [1], table 7.5F.4.3-1.

15) Set the Interferer signal level to the value defined for ACS2, GSM in table 4.2.6.3.2-1, with frequency below the wanted signal according to table 4.2.6.3.2-1, using a modulated interferer of 5 MHz bandwidth as defined in ETSI TS 136 521-1 [1], clause D.2.

16) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

17) Repeat steps 14 to 16, using an interfering signal above the wanted signal in step 15).

18) Set the Downlink signal level to the value defined for ACS2, E-UTRA according to table 4.2.6.3.2-1.

19) Set the Interferer signal level to the value defined for ACS2, E-UTRA in table 4.2.6.3.2-1, with frequency below the wanted signal according to table 4.2.6.3.2-1, using a modulated interferer of 5 MHz bandwidth as defined in ETSI TS 136 521-1 [1], clause D.2.

20) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

21) Repeat steps 18 to 20, using an interfering signal above the wanted signal at step 19).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5F.4.

5.3.5.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.6.2.2 in order to show compliance.

5.3.5.4 Receiver Adjacent Channel Selectivity (ACS) for UE category 0

5.3.5.4.1 Method of test

5.3.5.4.1.1 Initial conditions

Same initial conditions as in clause 5.3.5.1.1.1 with the following exceptions:

- Instead of table 7.5.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.5E.4.1-1 in ETSI TS 136 521-1 [1].
- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.4 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.5.4.1.2 Procedure

Same test procedure as in clause 5.3.5.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5E.

5.3.5.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.6.1.2 in order to show compliance.

5.3.5.5 Receiver Adjacent Channel Selectivity (ACS) for UE category M1

5.3.5.5.1 Method of test

5.3.5.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: 1,4 MHz, 3 MHz and 5 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.4 using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.5EA.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.5.5.1.2 Procedure

1) SS transmits PDSCH via M-PDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via M-PDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.5EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in table 4.2.6.1.2-2 (Case 1). Send Uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-2 (Case 1) for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the Throughput measurement.

4) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-2 (Case 1) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex D.

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Set the Downlink signal level to the value as defined in table 4.2.6.1.2-3 (Case 2). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-3 (Case 2) for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement.

7) Set the Interferer signal level to the value as defined in table 4.2.6.1.2-3 (Case 2) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex D.

8) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

9) Repeat for applicable channel bandwidths in both Case 1 and Case 2.

10) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5EA.

5.3.5.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.6.1.2 in order to show compliance.

5.3.6 Receiver Blocking Characteristics

5.3.6.1 Receiver Blocking Characteristics for Single Carrier

5.3.6.1.1 Method of test

5.3.6.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

For In-band blocking, the frequencies to be tested are mid-range as defined in ETSI TS 136 508 [2], clause 4.3.1.

For out-of-band blocking, the frequency to be tested is low or high range as defined in ETSI TS 136 508 [2], clause 4.3.1.

For Narrow-band blocking, the frequencies to be tested are mid-range as defined in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1. Range 3 of out-of-band blocking is tested only with the highest bandwidth.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.6.1.4.1-1, or table 7.6.2.4.1-1, or table 7.6.2.4.1-1 as applicable.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.6.1.1.2 In-Band Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to tables 4.2.7.1.2-1 and 4.2.7.1.2-2.

4) Set the downlink signal level according to the table 4.2.7.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3).

7) Repeat steps from 3 to 6, using interfering signals in Case 2 at steps 3) and 6). The ranges of case 2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [1], table 7.6.1.4.2-1.

8) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.1.

5.3.6.1.1.3 Out-Of-Band Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.7.1.2-4. The frequency step size is 1 MHz.

4) Set the downlink signal level according to the table 4.2.7.1.2-3. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-3 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) For table 4.2.7.1.2-4 record the frequencies for which the throughput does not meet the requirements.

7) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.2.

5.3.6.1.1.4 Narrow-Band Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to table 4.2.7.1.2-5.

4) Set the downlink signal level according to the table 4.2.7.1.2-5. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-5 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3).

7) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.3.

5.3.6.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.7.1.2 in order to show compliance.

5.3.6.2 Receiver Blocking Characteristics for Carrier Aggregation in DL-only bands

5.3.6.2.1 Method of test

5.3.6.2.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: Highest N_{RB_agg} for PCC and SCC.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.6.1A.3.4.1-1 for in-band blocking and table 7.6.2A.3.4.1-1 for out-of-band blocking and table 7.6.3A.3.4.1-1 for narrow-band blocking.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.6.2.1.2 In-Band Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.2 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.1A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.1A.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6) Set the parameters of the signal generator for an interfering signal below the SCC in Case 1 according to tables 4.2.7.1.2-1 and 4.2.7.2.2-1, or 4.2.7.1.2-1 and 4.2.7.2.2-1 for operating bands without uplink band (as noted in table 1-1), or 4.2.7.2.2-1a and 4.2.7.2.2-1b for operating band 46 without uplink band.

7) Set the downlink signal level according to the table 4.2.7.1.2-1 or table 4.2.7.2.2-1a for operating band 46. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-1 or table 4.2.7.2.2-1a for operating band 46 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement.

8) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

9) Repeat steps from 6 to 8, using an interfering signal above the SCC in Case 1 at step 6).

10) Repeat steps from 6 to 9, using interfering signals in Case 2 at steps 6) and 9). The ranges of case 2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [1], table 7.6.1.4.2-1.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.1A.3.

5.3.6.2.1.3 Out-Of-Band Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.2 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2A.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6) Set the parameters of the signal generator for an interfering signal below the SCC's operating band according to table 4.2.7.2.2-2 or table 4.2.7.2.2-2a for operating band 46. The frequency step size is 1 MHz.

7) Set the downlink signal level according to the table 4.2.7.1.2-3 for both carriers. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-3 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement.

8) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

9) Record the frequencies for which the throughput does not meet the requirements.

10) Repeat steps from 6 to 9, using an interfering signal above the SCC's operating band at step 6).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.2A.3.

5.3.6.2.1.4 Narrow-Band Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.3A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.3A.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6) Set the parameters of the CW signal generator for an interfering signal below the SCC according to table 4.2.7.1.2-5.

7) Set the downlink signal level according to the table 4.2.7.1.2-5. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-5 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement.

8) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

9) Repeat steps from 6 to 8, using an interfering signal above the SCC at step 6).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.3A.3.

5.3.6.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.7.2.2 in order to show compliance.

5.3.6.3 Receiver Blocking Characteristics for category NB1

5.3.6.3.1 Method of test

5.3.6.3.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

For both, in-band and out-of-band blocking, the frequencies to be tested are frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.1 as defined in ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connector using only the main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.2 and NPUSCH Format 2 is used to carry ACK/NACK on the uplink.

4) The DL Reference Measurement channel is set according to ETSI TS 136 521-1 [1], table 7.6.1F.4.1-1 for in-band blocking and table 7.6.2F.4.1-1 for out-of-band blocking.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.6.3.1.2 In-Band Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.1F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

2) Set the downlink signal level according to the table 4.2.7.3.2-1.

3) Set the parameters of the signal generator for an interfering signal below the wanted signal in IBB1 according to table 4.2.7.3.2-1.

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Repeat steps from 3 to 4, using an interfering signal above the wanted signal in IBB1 at step 3).

6) Repeat steps from 3 to 5, using interfering signals in IBB2 at steps 3) and 5). The ranges of IBB2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [1], table 7.6.1F.4.2-1.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.1F.4.

5.3.6.3.1.3 Out-Of-Band Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

2) Set the downlink signal level according to the table 4.2.7.3.2-2.

3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to table 4.2.7.3.2-2. The frequency step size is 1 MHz.

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Record the frequencies for which the throughput does not meet the requirements.

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.2F.4.

5.3.6.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.7.3.2 in order to show compliance.

5.3.6.4 Receiver Blocking Characteristics for UE category 0

5.3.6.4.1 Method of test

5.3.6.4.1.1 Initial conditions

Same initial conditions as in clause 5.3.6.1.1.1 with the following exceptions:

- Instead of table 7.6.1.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.6.1E.4.1-1 in ETSI TS 136 521-1 [1], or instead of table 7.6.2.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.6.2E.4.1-1 in ETSI TS 136 521-1 [1], or instead of table 7.6.3.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.6.3E.4.1-1 in ETSI TS 136 521-1 [1], as applicable.

- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.6.4.1.2 In-Band Procedure

Same test procedure as in clause 5.3.6.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.1E.

5.3.6.4.1.3 Out-Of-Band Procedure

Same test procedure as in clause 5.3.6.1.1.3.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.2E.

5.3.6.4.1.4 Narrow-Band Procedure

Same test procedure as in clause 5.3.6.1.1.4.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.3E.

5.3.6.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.7.1.2 in order to show compliance.

5.3.6.5 Receiver Blocking Characteristics for UE category M1

5.3.6.5.1 Method of test

5.3.6.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested:

- for In-band blocking: mid-range as defined in ETSI TS 136 508 [2], clause 4.3.1; or
- for out-of-band blocking: low or high range as defined in ETSI TS 136 508 [2], clause 4.3.1;
- for Narrow-band blocking: mid-range as defined in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: 5 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.6.1EA.4.1-1, 7.6.2EA.4.1-1 or 7.6.3EA.4.1-1, as applicable.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.6.5.1.2 In-Band Procedure

1) SS transmits PDSCH via MPDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.1EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The SS sends one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.1EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to tables 4.2.7.1.2-1 and 4.2.7.1.2-2.

4) Set the downlink signal level according to the table 4.2.7.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3).

7) Repeat steps from 3 to 6, using interfering signals in Case 2 at steps 3) and 6). The ranges of case 2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [1], table 7.6.1EA.4.2-1.

8) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.1EA.

5.3.6.5.1.3 Out-Of-Band Procedure

1) SS transmits PDSCH via MPDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The SS sends one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.7.1.2-4. The frequency step size is 1 MHz.

4) Set the downlink signal level according to the table 4.2.7.1.2-3. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-3 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) For table 4.2.7.1.2-4 record the frequencies for which the throughput does not meet the requirements.

7) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.2EA.

5.3.6.5.1.4 Narrow-Band Procedure

1) SS transmits PDSCH via MPDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.1EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The SS sends one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.3EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to table 4.2.7.1.2-5.

4) Set the downlink signal level according to the table 4.2.7.1.2-5. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.7.1.2-5 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3).

7) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.6.3EA.

5.3.6.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.7.1.2 in order to show compliance.

5.3.7 Receiver Spurious Response

5.3.7.1 Receiver Spurious Response for Single Carrier

5.3.7.1.1 Method of test

5.3.7.1.1.1 Initial conditions

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.1.1 in order to test spurious responses obtained in clause 5.3.6.1.2 under the same conditions.

5.3.7.1.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.8.1.2-2. The spurious frequencies are taken from step 5) records in clause 5.3.6.1.1.2.

4) Set the downlink signal level according to the table 4.2.8.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.8.1.2-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7.

5.3.7.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.8.1.2 in order to show compliance.

5.3.7.2 Receiver Spurious Response for Carrier Aggregation in DL-only bands

5.3.7.2.1 Method of test

5.3.7.2.1.1 Initial conditions

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.2.1.1 in order to test spurious responses obtained in clause 5.3.6.2.1.3 under the same conditions.

5.3.7.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.2 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2A.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.8.1.2-2. The spurious frequencies are taken from step 5) records in clause 5.3.6.2.1.3.

7) Set the downlink signal level according to the table 4.2.8.1.2-1 for both carriers. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.8.1.2-1 for carrier frequency $f \leq 3\ 0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz < $f \leq$ 4,2 GHz, for at least the duration of the throughput measurement.

8) For the spurious frequency, measure the average throughput on SCC for a duration sufficient to achieve statistical significance.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7A.3.

5.3.7.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.8.1.2 in order to show compliance.

5.3.7.3 Receiver Spurious Response for category NB1

5.3.7.3.1 Method of test

5.3.7.3.1.1 Initial conditions

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.3.1 in order to test spurious responses obtained in clause 5.3.6.3.2 under the same conditions.

5.3.7.3.1.2 Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

2) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.8.3.2-1. The spurious frequencies are taken from records in the final step of test procedures in clause 5.3.6.3.1.2.

3) Set the downlink signal level according to the table 4.2.8.3.2-1.

4) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7F.4.

5.3.7.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.8.3.2 in order to show compliance.

5.3.7.4 Receiver Spurious Response for UE category 0

5.3.7.4.1 Method of test

5.3.7.4.1.1 Initial conditions

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.4.1 in order to test spurious responses obtained in clause 5.3.6.4.2 under the same conditions.

5.3.7.4.1.2 Procedure

Same test procedure as in clause 5.3.7.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7E.

5.3.7.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.8.1.2 in order to show compliance.

5.3.7.5 Receiver Spurious Response for UE category M1

5.3.7.5.1 Method of test

5.3.7.5.1.1 Initial conditions

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.5.1 in order to test spurious responses obtained in clause 5.3.6.5.2 under the same conditions.

5.3.7.5.1.2 Procedure

1) SS transmits PDSCH via MPDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2E.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The SS sends one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2E.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the parameters of the CW signal generator for an interfering signal according to table 4.2.8.1.2-2. The spurious frequencies are taken from step 5) records in clause 5.3.6.5.1.2.

4) Set the downlink signal level according to the table 4.2.8.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.8.1.2-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7EA.

5.3.7.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.8.1.2 in order to show compliance.

5.3.8 Receiver Intermodulation Characteristics

5.3.8.1 Receiver Intermodulation Characteristics for Single Carrier

5.3.8.1.1 Method of test

5.3.8.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS and interfering sources to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.8.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.8.1.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.8.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.8.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in table 4.2.9.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.9.1.2-1 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4{,}2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

4) Set the Interfering signal levels to the values as defined in table 4.2.9.1.2-1, using a modulated interferer bandwidth as defined in annex D of ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.8.

5.3.8.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.9.1.2 in order to show compliance.

5.3.8.2 Receiver Intermodulation Characteristics for Carrier Aggregation in DL-only bands

5.3.8.2.1 Method of test

5.3.8.2.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: Highest N_{RB_agg} for PCC and SCC.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS and interfering sources to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.8.1A.3.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.8.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.8.1A.3.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.8.1A.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6) Set the Downlink signal level to the value as defined in table 4.2.9.1.2-1 or table 4.2.9.2.2-1 for operating band 46. Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.9.1.2-1 or table 4.2.9.2.2-1 for operating band 46 for carrier frequency $f \leq 3{,}0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz < $f \leq 4{,}2$ GHz, for at least the duration of the Throughput measurement.

7) Set the Interfering signal levels to the values as defined in table 4.2.9.1.2-1 or table 4.2.9.2.2-1 for operating band 46, and frequency below the wanted signal, using a modulated interferer bandwidth as defined in annex D of ETSI TS 136 521-1 [1].

8) Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

9) Repeat steps from 6 to 8, using an interfering signal above the wanted signal at step 4).

5.3.8.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.9.2.2 in order to show compliance.

5.3.8.3 Receiver Intermodulation Characteristics for category NB1

5.3.8.3.1 Test requirements

5.3.8.3.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: Frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.1, see ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only the main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.2 and NPUSCH Format 2 is used to carry ACK/NACK on the uplink.

4) The DL Reference Measurement channel is set according to ETSI TS 136 521-1 [1], table 7.8.1F.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.8.3.1.2 Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.8.1F.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send HARQ feedback based on information contained in DCI format N1.

2) Set the Downlink signal level to the value as defined in table 4.2.9.3.2-1.

3) Set the Interfering signal levels to the values as defined in table 4.2.9.3.2-1 and frequency below the wanted signal, using a modulated interferer bandwidth as defined in annex D of ETSI TS 136 521-1 [1].

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Repeat steps from 2 to 4, using an interfering signal above the wanted signal in step 3).

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.8.1F.4.

5.3.8.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.9.3.2 in order to show compliance.

5.3.8.4 Receiver Intermodulation Characteristics for UE category 0

5.3.8.4.1 Method of test

5.3.8.4.1.1 Initial conditions

Same initial conditions as in clause 5.3.8.1.1.1 with the following exceptions:

- Instead of table 7.8.1.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.8.1E.4.1-1 in ETSI TS 136 521-1 [1].
- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.6 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.8.4.1.2 Procedure

Same test procedure as in clause 5.3.8.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.8.1E.

5.3.8.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.9.1.2 in order to show compliance.

5.3.8.5 Receiver Intermodulation Characteristics for UE category M1

5.3.8.5.1 Method of test

5.3.8.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested:5 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.6 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.
4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.8.1EA.4.1-1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.8.5.1.2 Procedure

1) SS transmits PDSCH via MPDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.8.1EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.8.1EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the value as defined in table 4.2.9.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.9.1.2-1 for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency 3,0 GHz $< f \leq 4,2$ GHz, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

4) Set the Interfering signal levels to the values as defined in table 4.2.9.1.2-1, using a modulated interferer bandwidth as defined in annex D of ETSI TS 136 521-1 [1].

5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

6) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.8.1EA.

5.3.8.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.9.1.2 in order to show compliance.

5.3.9 Receiver Spurious Emissions

5.3.9.1 Receiver Spurious Emissions for Single Carrier

5.3.9.1.1 Method of test

5.3.9.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1.

4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 7.9.4.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.9.1.1.2 Procedure

1) Sweep the spectrum analyser (or other suitable test equipment) over a frequency range from 30 MHz to 12,75 GHz and measure the average power of the spurious emissions.

2) Repeat step 1) for all E-UTRA Rx antennas of the UE.

3) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9.

5.3.9.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.10.1.2 in order to show compliance.

5.3.9.2 Receiver Spurious Emissions in DL-only bands

5.3.9.2.1 Method of test

5.3.9.2.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: Highest N_{RB_agg} for PCC and SCC as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1.

4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 7.9A.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.9.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 for all downlink physical channels except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 2A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.9A.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) Sweep the spectrum analyser (or equivalent equipment) over a frequency range and measure the average power of spurious emission. During measurement, SS sends no uplink scheduling information to the UE.

6) Repeat steps 1) to 5) for all E-UTRA DL-only band Rx antennas of the UE.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9A.

5.3.9.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.10.2.2 in order to show compliance.

5.3.9.3 Receiver Spurious Emissions for UE category 0

5.3.9.3.1 Method of test

5.3.9.3.1.1 Initial conditions

Same initial conditions as in clause 5.3.9.1.1.1 with the following exceptions:

- Instead of clause 7.9.4.1 in ETSI TS 136 521-1 [1] → use clause 7.9E.4.1 in ETSI TS 136 521-1 [1].
- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.8 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.9.3.1.2 Procedure

Same test procedure as in clause 5.3.9.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9E.

5.3.9.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.10.1.2 in order to show compliance.

5.3.9.4 Receiver Spurious Emissions for UE category M1

5.3.9.4.1 Method of test

5.3.9.4.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: 5 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.7 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1.
4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 7.9EA.4.1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.9.4.1.2 Procedure

Same test procedure as in clause 5.3.9.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9EA.

5.3.9.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.10.1.2 in order to show compliance.

5.3.9.5 Receiver Spurious Emissions for UE category NB1

5.3.9.5.1 Method of test

5.3.9.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.8 using only main UE Tx/Rx antenna.
2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1.
4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 7.9F.4.1.
5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.
6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5. Message contents are defined in clause 7.9F.4.3.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.9.5.1.2 Procedure

Same test procedure as in clause 5.3.9.1.1.2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9F.

5.3.9.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.10.1.2 in order to show compliance.

5.3.10 Transmitter Adjacent Channel Leakage Power Ratio

5.3.10.1 Transmitter adjacent channel leakage power ratio for Single Carrier

5.3.10.1.1 Method of test

5.3.10.1.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.1.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuous uplink power control "up" commands in the uplink scheduling information to the UE to ensure that the UE transmits at P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 4.2.11.1.2-1 and 4.2.11.1.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Measure the filtered mean power for E-UTRA.

5) Measure the filtered mean power of the first E-UTRA adjacent channel.

6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel.

7) Calculate the ratio of the power between the values measured in step 4) over step 5) for $E\text{-}UTRA_{ACLR}$.

8) Calculate the ratio of the power between the values measured in step 4) over step 6) for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$.

9) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3.

5.3.10.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.1.2 in order to show compliance.

5.3.10.2 Transmitter adjacent channel leakage power ratio for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

5.3.10.2.1 Method of test

5.3.10.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.3A.1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.2.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.2.3A.1.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the mean power over all component carriers of the UE in the CA configuration of the radio access mode according to the test configuration, which shall meet the requirements described in tables 4.2.11.2.2-1 and 4.2.11.2.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Measure the rectangular filtered mean power for CA E-UTRA.

8) Measure the rectangular filtered mean power of the first CA E-UTRA adjacent channel on both lower and upper side of the CA E-UTRA channel, respectively.

9) Measure the RRC filtered mean power of the first and the second UTRA for CA adjacent channel on both lower and upper side of the CA E-UTRA channel, respectively.

10) Calculate the ratio of the power between the values measured in step 7) over step 8) for CA E-UTRA$_{ACLR}$.

11) Calculate the ratio of the power between the values measured in step 7) over step 9) for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$.

12) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3A.1.

5.3.10.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.2.2 in order to show compliance.

5.3.10.2A Transmitter adjacent channel leakage power ratio for inter-band Carrier Aggregation (DL CA and UL CA)

5.3.10.2A.1 Method of test

5.3.10.2A.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range for PCC and SCC, high range for PCC and SCC; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Test CC Combination setting (N_{RB_agg}): lowest $N_{RB\_agg,}$ highest N_{RB_agg}, as specified in ETSI TS 136 521-1 [1], clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.3A.2.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.2A.1.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.2.3A.2.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

6) Measure the mean power over all component carriers of the UE in the CA configuration of the radio access mode according to the test configuration, which shall meet the requirements described in table 4.2.2.2.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

7) Measure the rectangular filtered mean power for CA E-UTRA in the first band of the CA configuration.

8) Measure the rectangular filtered mean power of the first CA E-UTRA adjacent channel on both lower and upper side of the CA E-UTRA channel in the first band of the CA configuration, respectively.

9) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel on both lower and upper side of the CA E-UTRA channel in the first band of the CA configuration, respectively.

10) Calculate the ratio of the power between the values measured in step 7) over step 8) for CA E-UTRA$_{ACLR}$.

11) Calculate the ratio of the power between the values measured in step 7) over step 9) for UTRA$_{ACLR1}$, UTRA$_{ACLR2}$.

12) Repeat steps 6) to 11) for the second band of the CA configuration.

13) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3A.2.

5.3.10.2A.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.1.2 in order to show compliance.

5.3.10.3 Transmitter adjacent channel leakage power ratio for UL-MIMO

5.3.10.3.1 Method of test

5.3.10.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.3B.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.3.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 6.6.2.3B.1.4.1-1 of ETSI TS 136 521-1 [1]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.

3) Measure the sum of the mean power at each antenna connector of UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 4.2.11.3.2-1 and 4.2.11.3.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Measure the rectangular filtered mean power for E-UTRA at each antenna connector of UE.

5) Measure the rectangular filtered mean power of the first E-UTRA adjacent channel at each antenna connector of UE.

6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel at each antenna connector of UE.

7) Calculate the ratio of the power between the values measured in step 4) over step 5) for $E\text{-}UTRA_{ACLR}$.

8) Calculate the ratio of the power between the values measured in step 4) over step 6) for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3B.

5.3.10.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.3.2 in order to show compliance.

5.3.10.4 Transmitter adjacent channel leakage power ratio for Multi-Cluster PUSCH within a component carrier

5.3.10.4.1 Method of test

5.3.10.4.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: Highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.3_2.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.4.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.3_2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuous uplink power control "up" commands in the uplink scheduling information to the UE to ensure that the UE transmits at P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 4.2.11.1.2-1 and 4.2.11.1.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

4) Measure the filtered mean power for E-UTRA.

5) Measure the filtered mean power of the first E-UTRA adjacent channel.

6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel.

7) Calculate the ratio of the power between the values measured in step 4) over step 5) for $E\text{-}UTRA_{ACLR}$.

8) Calculate the ratio of the power between the values measured in step 4) over step 6) for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$.

9) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3.2.

5.3.10.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.4.2 in order to show compliance.

5.3.10.5 Transmitter adjacent channel leakage power ratio for category NB1

5.3.10.5.1 Method of test

5.3.10.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.2, see ETSI TS 136 508 [2], clause 8.1.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE to the UE antenna connectors using only main Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1.1 and H.4.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], clause 6.6.2.3F.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.5.1.2 Procedure

1) SS sends uplink scheduling information for the UL HARQ process via NPDCCH DCI format N0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.3F.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC (UE should be ready transmitting P_{UMAX} after Initial Conditions setting).

2) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in table 4.2.11.5.2-1. The measurement period is at least one sub-frame **(**1 ms) for 15 kHz channel spacing, and at least a 2 ms slot (excluding the 2 304Ts gap when UE is not transmitting) respectively for the 3,75 kHz channel spacing.

3) Measure the rectangular filtered mean power for category NB1 UE channel.

4) Measure the rectangular filtered mean power of the GSM adjacent channel on both lower and upper side of the category NB1 UE channel, respectively.

5) Measure the RRC filtered mean power of UTRA adjacent channel on both lower and upper side of the category NB1 UE channel, respectively.

6) Calculate the ratios of the power between the value measured in step 3) over step 4) for lower and upper GSM_{ACLR}.

7) Calculate the ratio of the power between the value measured in step 3) over step 5) for lower and upper $UTRA_{ACLR}$.

NOTE: For configuration IDs applicable to UE depending on UE capability in Test Configuration Table with different UL sub-carrier spacing, the SS releases the connection through State 3A-NB and finally ensures that the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5 using the appropriate UL subcarrier spacing in Random Access Response message.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3F.

5.3.10.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.5.2 in order to show compliance.

5.3.10.6 Transmitter adjacent channel leakage power ratio for UE category 0

5.3.10.6.1 Method of test

5.3.10.6.1.1 Initial conditions

Same initial conditions as in clause 5.3.10.1.1.1 with following exceptions:

- Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.6.1.2 Procedure

Same test procedure as in clause 5.3.10.1.1.2 with following exception for HD-FDD:

- In step 3), slots with transient periods are not under test. Half-duplex guard subframes are not under test.
- Instead of table 6.6.2.3.4.1-1 in ETSI TS 136 521-1 [1] → use table 6.6.2.3E.4.1-1 in ETSI TS 136 521-1 [1].

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3E.

5.3.10.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.1.2 in order to show compliance.

5.3.10.7 Transmitter adjacent channel leakage power ratio for UE category M1

5.3.10.7.1 Method of test

5.3.10.7.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, mid-range and high range; see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.3 using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.0 and uplink signals according to clauses H.1 and H.3.0.

4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 6.6.2.3EA.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.10.7.1.2 Procedure

1) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.3EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in tables 4.2.11.1.2-1 and 4.2.11.1.2-2. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test. For HD-FDD slots with transient periods and Half-duplex guard subframe are not under test.

4) Measure the filtered mean power for E-UTRA.

5) Measure the filtered mean power of the first E-UTRA adjacent channel.

6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel.

7) Calculate the ratio of the power between the values measured in step 4) over step 5) for $E\text{-}UTRA_{ACLR}$.

8) Calculate the ratio of the power between the values measured in step 4) over step 6) for $UTRA_{ACLR1}$, $UTRA_{ACLR2}$.

9) Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3EA.

5.3.10.7.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.11.1.2 in order to show compliance.

5.3.11 Receiver Reference Sensitivity Level

5.3.11.1 Receiver Reference Sensitivity Level for Single Carrier

5.3.11.1.1 Method of test

5.3.11.1.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.3.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.11.1.1.2 Procedure

1) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the appropriate REFSENS value defined in table 4.2.12.1.2-1. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement. (obtain correct UE output power as specified in ETSI TS 136 521-1 [1]).

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.3.

5.3.11.1.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.12.1.2 in order to show compliance.

5.3.11.2 Receiver Reference Sensitivity Level for Carrier Aggregation in DL-only bands

5.3.11.2.1 Method of test

5.3.11.2.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: mid-range as defined ETSI TS 136 508 [2], clause 4.3.1, unless otherwise specified in the tables 7.3A.3.4.1-2 to 7.3A.3.4.1-29 in ETSI TS 136 521-1 [1].

Channel bandwidth to be tested: Highest N_{RB_agg} as defined in ETSI TS 136 508 [2], clause 4.3.1, unless otherwise specified in tables 7.3A.3.4.1-2 to 7.3A.3.4.1-29 in ETSI TS 136 521-1 [1].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure group A.32 as appropriate if the UE supports 2 Rx antennas or figure group A.80 if the UE supports 4 Rx antennas in the band.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1, and uplink signals according to ETSI TS 136 521-1 [1], clauses H.1 and H.3.0.

4) The UL and DL Reference Measurement channels are set according to table 7.3A.3.4.1-1 in ETSI TS 136 521-1 [1].

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.11.2.2 Procedure

1) Configure SCC according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 for all downlink physical channels.

2) The SS shall configure SCC as per ETSI TS 136 508 [2], clause 5.2A.4.

3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.

4) SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to table 7.3A.3.4.1-1 of ETSI TS 136 521-1 [1] on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to table 7.3A.3.4.1-1 of ETSI TS 136 521-1 [1] on PCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6) Set the Downlink signal level for PCC and SCC to the appropriate REFSENS value defined in table 4.2.12.2.2-1. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement.

7) Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], clause G.2A.

5.3.11.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.12.2.2 in order to show compliance.

5.3.11.3 Receiver Reference Sensitivity Level for category NB1

5.3.11.3.1 Method of test

5.3.11.3.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: Frequency ranges defined in ETSI TS 136 521-1 [1], clause K.1.2, see ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors using only the main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 8.1.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and NPUSCH Format 2 is used to carry ACK/NACK on the uplink.

4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.3F.1.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 2A-NB with CP CIoT Optimization according to ETSI TS 136 508 [2], clause 8.1.5.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.11.3.1.2 Procedure

1) SS transmits NPDSCH via NPDCCH DCI format N1 for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.3F.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The UE will send the HARQ feedback based on information contained in DCI format N1.

2) Set the Downlink signal level to the REFSENS value defined in table 4.2.12.2.2-1.

3) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.3F.1.4.

5.3.11.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.12.2.2 in order to show compliance.

5.3.11.4 Receiver Reference Sensitivity Level for UE category 0

5.3.11.4.1 Method of test

5.3.11.4.1.1 Initial conditions

Same initial conditions as in clause 5.3.11.1.1.1 with the following exceptions:

- Instead of table 7.3.4.1-1 in ETSI TS 136 521-1 [1] → use table 7.3E.4.1-1 in ETSI TS 136 521-1 [1].
- Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2] annex A, figure A.3 using only main UE Tx/Rx antenna.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.11.4.1.2 Procedure

Same test procedure as in clause 5.3.11.1.1.2 with the following exceptions:

- Instead of table 4.2.12.1.2-1 → use tables 4.2.12.4.2-1 and 4.2.12.4.2-2.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.3E.

5.3.11.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.12.3.2 in order to show compliance.

5.3.11.5 Receiver Reference Sensitivity Level for UE category M1

5.3.11.5.1 Method of test

5.3.11.5.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid-range, high range see ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: 5 MHz channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

1) Connect the SS to the UE antenna connectors as shown in ETSI TS 136 508 [2], annex A, figure A.3 using only main UE Tx/Rx antenna.

2) The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

3) Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.1.

4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.3EA.4.1-1.

5) Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

6) Ensure the UE is in State 3A-RF-CE according to ETSI TS 136 508 [2], clause 5.2A.2AA.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

5.3.11.5.1.2 Procedure

1) SS transmits PDSCH via M-PDCCH DCI format 6-1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.3EA.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The SS sends one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1 and A.5.2.1.

2) SS sends uplink scheduling information for each UL HARQ process via MPDCCH DCI format 6-0A for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.3EA.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3) Set the Downlink signal level to the appropriate REFSENS value defined in table 4.2.12.4.2-1 for FDD and TDD and in table 4.2.12.4.2-2 for HD-FDD. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement.

4) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

5) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.3EA.

5.3.11.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.12.4.2 in order to show compliance.

5.3.12 Receiver Total Radiated Sensitivity (TRS)

5.3.12.1 Method of test

5.3.12.1.1 Initial conditions

Initial conditions are described in ETSI TS 137 544 [6], clause 7.1.5.4.1 for FDD and clause 7.1.6.4.1 for TDD systems.

5.3.12.1.2 Procedure

Procedure is described in ETSI TS 137 544 [6], clause 7.1.5.4.2 for FDD and clause 7.1.6.4.2 for TDD systems.

In case devices support adaptive features that dynamically tune the RF front end and adjust TX power for optimum performance in its region of operation, the device being measured should be representative of the device configuration used by a consumer in that region. This could include setting the MCC value or another parameter to one used within the region.

5.3.12.1.3 Procedure, reverberation chamber method

Refer to ETSI TS 137 544 [6], clause 7.1.5.4.3 for FDD and clause 7.1.6.4.3 for TDD systems.

5.3.12.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.13.2 in order to show compliance.

5.3.13 Total Radiated Power (TRP)

5.3.13.1 Method of test

5.3.13.1.1 Initial conditions

Initial conditions are described in ETSI TS 137 544 [6], clause 6.1.5.4.1 for FDD and clause 6.1.6.4.1. for TDD systems.

5.3.13.1.2 Procedure

Procedure is described in ETSI TS 137 544 [6], clause 6.1.5.4.2.for FDD and clause 6.1.6.4.2 for TDD systems.

In case devices support adaptive features that dynamically tune the RF front end and adjust TX power for optimum performance in its region of operation, the device being measured should be representative of the device configuration used by a consumer in that region. This could include setting the MCC value or another parameter to one used within the region.

For devices supporting transmit antenna switching using multiple TX antennas, the TRP should be measured for each transmit antenna individually. The antenna with the greater TRP should be used to determine the pass/fail compliance.

5.3.13.1.3 Procedure, reverberation chamber method

Refer to ETSI TS 137 544 [6], clause 6.1.5.4.3 for FDD and clause 6.1.6.4.3. for TDD systems.

5.3.13.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.14.2 in order to show compliance.

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A-1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table A-1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 301 908-13					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Transmitter Maximum Output Power	3.2	4.2.2	U	
2	Transmitter Spectrum Emission Mask	3.2	4.2.3	U	
3	Transmitter Spurious Emissions	3.2	4.2.4	U	
4	Transmitter Minimum Output Power	3.2	4.2.5	U	
5	Receiver Adjacent Channel Selectivity (ACS)	3.2	4.2.6	U	
6	Receiver Blocking Characteristics	3.2	4.2.7	U	
7	Receiver Spurious Response	3.2	4.2.8	U	
8	Receiver Intermodulation Characteristic	3.2	4.2.9	U	
9	Receiver Spurious Emissions	3.2	4.2.10	U	
10	Transmitter Adjacent Channel Leakage Power Ratio	3.2	4.2.11	U	
11	Receiver Reference Sensitivity Level	3.2	4.2.12	U	
12	Receiver Total Radiated Sensitivity (TRS)	3.2	4.2.13	U	
13	Total Radiated Power (TRP)	3.2	4.2.14	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (normative): Environmental profile

B.1 General

B.1.1 Introduction

This annex specifies the environmental profile of the UE.

B.1.2 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table B.1.2-1: Temperature Test Environment

+15 °C to +35 °C	For normal conditions (with relative humidity up to 75 %)
-10 °C to +55 °C	For extreme conditions (see IEC 60068-2-1 [4] and IEC 60068-2-2 [5])

The normative reference for this requirement is ETSI TS 136 101 [3], clause E.1.

Some tests are performed also in extreme temperature conditions. These test conditions are denoted as TL (Temperature Low, -10 °C) and TH (Temperature High, +55 °C).

B.1.3 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

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 B.1.3-1: Voltage Test Environment

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 Lithium Mercury/nickel and cadmium	 0,85 × nominal 0,95 × nominal 0,90 × nominal	 Nominal 1,1 × Nominal	 Nominal 1,1 × 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 ETSI TS 136 101 [3] for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

The normative reference for this requirement is ETSI TS 136 101 [3], clause E.2.

Some tests are performed also in extreme voltage conditions. These test conditions are denoted as Lower extreme Voltage (VL) and Higher extreme Voltage (VH).

B.1.4 Test environment

Where a normal environment is required then the normal conditions shown in clauses B.1.2 and B.1.3 shall be applied.

Where an extreme environment is required then the various combinations of extreme temperatures together with the extreme voltages shown in clauses B.1.2 and B.1.3 shall be applied. The combinations are:

- Low extreme Temperature/Low extreme Voltage (TL/VL);
- Low extreme Temperature/High extreme Voltage (TL/VH);
- High extreme Temperature/Low extreme Voltage (TH/VL);
- High extreme Temperature/High extreme Voltage (TH/VH).

Annex C (informative): Maximum Measurement Uncertainty

The measurements described in the present document are based on the following assumptions:

- the measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter is included in the test report.

Table C.1 shows the recommended values for the maximum measurement uncertainty figures.

Table C.1: Maximum measurement uncertainty

Parameter	Uncertainty
Transmitter maximum output power	±0,7 dB
Transmitter spectrum emissions mask	±1,5 dB
Transmitter spurious emissions 9 kHz < f ≤ 4 GHz 4 GHz < f ≤ 12,75 GHz	±2,0 dB ±4,0 dB
Transmitter Minimum output power	±1,0 dB
Receiver Adjacent Channel Selectivity (ACS)	±1,1 dB
Receiver Blocking characteristics 1 MHz < $f_{interferer}$ ≤ 3 GHz 3 GHz < $f_{interferer}$ ≤ 12,75 GHz	±1,3 dB ±3,2 dB
Receiver spurious response 1 MHz < $f_{interferer}$ ≤ 3 GHz 3 GHz < $f_{interferer}$ ≤ 12,75 GHz	±1,3 dB ±3,2 dB
Receiver intermodulation characteristics	±1,4 dB
30 MHz ≤ f ≤ 4,0 GHz 4 GHz < f ≤ 12,75 GHz	±2,0 dB ±4,0 dB
Transmitter adjacent channel leakage power ratio	±0,8 dB
Receiver Reference Sensitivity Level f ≤ 4,0 GHz 4 GHz < f ≤ 12,75 GHz	±0,7 dB ±1,0 dB
NOTE 1: For RF tests it should be noted that the uncertainties in table C-1 apply to the test system operating into a nominal 50 Ω load and do not include system effects due to mismatch between the EUT and the test system. NOTE 2: If the test system for a test is known to have a measurement uncertainty greater than that specified in table C-1, this equipment can still be used provided that an adjustment is made as follows: any additional uncertainty in the test system over and above that specified in table C-1 should be used to tighten the test requirements - making the test harder to pass (for some tests, e.g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a test system not compliant with table C-1 does not increase the probability of passing an EUT that would otherwise have failed a test if a test system compliant with table C-1 had been used.	

Annex D (informative): Bibliography

- Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC (EMC Directive).
- CEPT/ERC/REC 74-01 (Siófok 1998, Nice 1999, Sesimbra 2002, Hradec Kralove 2005, Cardiff 2011): "Unwanted Emissions in the Spurious Domain".
- Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).
- Commission Decision (EU) 2015/750 of 8 May 2015 on the harmonisation of the 1 452-1 492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union.
- Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.
- Commission Decision 2005/513/EC of 11 July 2005 on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs).
- Commission Decision 2007/90/EC of 12 February 2007 amending Decision 2005/513/EC on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs).
- Commission Implementing Decision (EU) 2018/637 amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community as regards relevant technical conditions for the Internet of Things.
- Commission Implementing Decision 2012/688/EU on the harmonisation of the frequency bands 1920-1980 MHz and 2110-2170 MHz for terrestrial systems capable of providing electronic communications services in the Union - Press Release.
- ETSI TR 103 288 (V1.1.1) (05-2015): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Report of the CENELEC/ETSI Joint Working Group in response to the EC letter ENTRP/F5/DP/MM/entr.f5.(2013)43164 to the ESOs".

Annex E (informative): Change history

Version	Information about changes
11.1.4	Stable draft with new features up to release 13 March 2018
11.1.7	Final draft for approval with resolved comments received from EC early assessment December 2018
11.1.8	Minor editorial change in 5.3.2.1.1 and Ready for second Around Assessment January 2019
11.1.9	Final draft with resolved comments from second around EC early assessment
11.1.10	Band 65 for NB1 feature is added and an error/typo for protecting emission from Band 28 to Band 32 in table 4.2.4.1.2-3 is corrected, July 2019
13.2.0	Included Over The Air (OTA) antenna performance requirements in terms of Receiver Total Radiated Sensitivity (TRS) and Total Radiated Power (TRP)

History

Document history		
V4.2.1	March 2010	Publication
V5.2.1	May 2011	Publication
V6.2.1	October 2013	Publication
V7.1.1	December 2015	Publication
V11.1.1	July 2016	Publication
V11.1.2	July 2017	Publication
V13.1.1	November 2019	Publication
V13.2.1	February 2022	Publication
V13.3.0	July 2024	SRdAP EV 20241001: 03/07/2024 to 01/10/2024
V13.3.1	October 2024	Publication