



**IMT cellular networks;
Harmonised Standard for access to radio spectrum;
Part 24: New Radio (NR) Base Stations (BS)
Release 15**

Reference

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Mobile Standards Group (MSG), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

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.1] 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 24 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.6].

Proposed national transposition dates	
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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).

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Introduction

The present document is part of a set of standards developed by ETSI that are designed to fit in a modular structure to cover radio 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 specifies technical characteristics and methods of measurements for types of radio equipment:

- Base Stations for New Radio (NR).

These radio equipment types are capable of operating in whole or any part of the *operating band(s)* given in tables 1-2 and 1-3. FR1 and FR2 frequency ranges are defined as in table 1-1.

Table 1-1: Frequency ranges

Frequency range designation	Frequency range
FR1	410 MHz to 7 125 MHz
FR2	24 250 MHz to 52 600 MHz

Table 1-2: NR Base Station operating bands in FR1

NR band	Direction of transmission	NR operating bands	Related EC/ECC decision
n1	Transmit	2 110 MHz to 2 170 MHz	[i.19] and [i.20]
	Receive	1 920 MHz to 1 980 MHz	
n3	Transmit	1 805 MHz to 1 880 MHz	[i.17] and [i.18]
	Receive	1 710 MHz to 1 785 MHz	
n7	Transmit	2 620 MHz to 2 690 MHz	[i.21] and [i.13]
	Receive	2 500 MHz to 2 570 MHz	
n8	Transmit	925 MHz to 960 MHz	[i.17] and [i.18]
	Receive	880 MHz to 915 MHz	
n20	Transmit	791 MHz to 821 MHz	[i.12] and [i.13]
	Receive	832 MHz to 862 MHz	
n28 (note 1)	Transmit	758 MHz to 803 MHz	[i.10] and [i.11]
	Receive	703 MHz to 748 MHz	
n38	Transmit	2 570 MHz to 2 620 MHz	[i.22] and [i.23]
	Receive	2 570 MHz to 2 620 MHz	
n40	Transmit	2 300 MHz to 2 400 MHz	[i.21]
	Receive	2 300 MHz to 2 400 MHz	
n41 (note 2)	Transmit	2 496 MHz to 2 690 MHz	[i.22] and [i.23]
	Receive	2 496 MHz to 2 690 MHz	
n50 (note 3)	Transmit	1 432 MHz to 1 517 MHz	[i.14] and [i.15] and [i.16]
	Receive	1 432 MHz to 1 517 MHz	
n51 (note 3, note 6)	Transmit	1 427 MHz to 1 432 MHz	[i.14] and [i.15]
	Receive	1 427 MHz to 1 432 MHz	
n65 (note 7)	Transmit	2 110 MHz to 2 200 MHz	[i.19], [i.20] and [i.27]
	Receive	1 920 MHz to 2 010 MHz	
n75 (note 3)	Transmit	1 432 MHz to 1 517 MHz	[i.14], [i.15] and [i.16]
	Receive	N/A	
n76 (notes 3 and 6)	Transmit	1 427 MHz to 1 432 MHz	[i.14] and [i.15]
	Receive	N/A	
n77 (note 4)	Transmit	3 300 MHz to 4 200 MHz	[i.8] and [i.24]
	Receive	3 300 MHz to 4 200 MHz	
n78 (note 5)	Transmit	3 300 MHz to 3 800 MHz	[i.8] and [i.24]
	Receive	3 300 MHz to 3 800 MHz	
n80	Transmit	N/A	[i.17] and [i.18]
	Receive	1 710 MHz to 1 785 MHz	
n81	Transmit	N/A	[i.17] and [i.18]
	Receive	880 MHz to 915 MHz	
n82	Transmit	N/A	[i.12] and [i.13]
	Receive	832 MHz to 862 MHz	
n83	Transmit	N/A	[i.10] and [i.11]
	Receive	703 MHz to 748 MHz	

NR band	Direction of transmission	NR operating bands	Related EC/ECC decision
n84	Transmit	N/A	
	Receive	1 920 MHz to 1 980 MHz	[i.19] and [i.20]
NOTE 1: In Europe, according to [i.12] and [i.13], radio equipment in band 28 operates between 758 MHz and 791 MHz for the transmitter ($F_{DL_low} = 758$ MHz and $F_{DL_high} = 791$ MHz) and between 703 MHz and 736 MHz for the receiver ($F_{UL_low} = 703$ MHz and $F_{UL_high} = 736$ MHz).			
NOTE 2: In Europe according to [i.22] and [i.23], radio equipment in band 41 operates between 2 570 MHz and 2 620 MHz ($F_{DL_low} = 2 570$ MHz and $F_{DL_high} = 2 620$ MHz).			
NOTE 3: Radio equipment in bands n50 and n51 only operates in transmit mode (downlink only). Only transmitter requirements are applicable.			
NOTE 4: In Europe, according to [i.24] and [i.8], radio equipment in band n77 operates between 3 400 MHz and 3 800 MHz ($F_{DL_low} = 3 400$ MHz and $F_{DL_high} = 3 800$ MHz).			
NOTE 5: In Europe, according to [i.24] and [i.8], radio equipment in band n78 operates between 3 400 MHz and 3 800 MHz ($F_{DL_low} = 3 400$ MHz and $F_{DL_high} = 3 800$ MHz).			
NOTE 6: Only requirements for Local Area <i>BS class</i> are defined.			
NOTE 7: This band includes two frequency ranges that are harmonised in Europe:			
(a) According to [i.19] and [i.20], 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.27], 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.			

Table 1-3: NR Base Station operating bands in FR2

NR band	Direction of transmission	NR Base Station operating bands	Relevant EC/ECC decision
n257 (note)	Transmit	26 500 MHz to 29 500 MHz	[i.25] and [i.26]
	Receive	26 500 MHz to 29 500 MHz	
n258	Transmit	24 250 MHz to 27 500 MHz	[i.25] and [i.26]
	Receive	24 250 MHz to 27 500 MHz	
NOTE: In Europe according to [i.25] and [i.26], radio equipment in band n257 operates between 26 500 MHz and 27 500 MHz (F _{UL low} = 26 500 MHz and F _{UL high} = 27 500 MHz).			

The present document covers conducted and radiated requirements for NR Base Stations for 3GPP Release 15. Additionally, it includes requirements for selected NR *operating bands* from 3GPP Release 16.

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

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 138 141-1 (V15.12.0) (04-2022): "5G; NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing (3GPP TS 38.141-1 version 15.12.0 Release 15)".

- [2] ETSI TS 138 141-2 (V15.14.0) (06-2022): "5G; NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing (3GPP TS 38.141-2 version 15.14.0 Release 15)".
- [3] ETSI TS 138 104 (V15.17.0) (06-2022): "5G; NR; Base Station (BS) radio transmission and reception (3GPP TS 38.104 version 15.17.0 Release 15)".
- [4] ETSI EN 301 908-18 (V15.1.1) (09-2021): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 18: E-UTRA, UTRA and GSM/EDGE Multi-Standard Radio (MSR) Base Station (BS) Release 15".
- [5] ETSI EN 301 908-23 (V15.1.0) (12-2022): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 23: Active Antenna System (AAS) Base Station (BS); Release 15".

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] 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.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 (09-2012): "Unwanted emissions in the spurious domain".
- [i.5] ETSI TR 100 028 (parts 1 and 2) (V1.4.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.6] ETSI EN 301 908-1 (V15.1.1) (04-2022): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 1: Introduction and common requirements Release 15".
- [i.7] Recommendation ERC 74-01 (05-2019): "Unwanted emissions in the spurious domain".
- [i.8] 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.9] ETSI TS 103 807 (V1.1.1) (06-2021): "Mobile Standards Group (MSG); IMT Cellular Networks Base Stations (BS) Additional Regulatory Requirements".
- [i.10] 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.11] 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.12] 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.13] ECC Decision (09)03: "Harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz", 30 October 2009.
- [i.14] 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.15] 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.16] ECC Decision 17(06): "The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)", Approved 17 November 2017, corrected 2 March 2018.
- [i.17] 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.18] 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.19] 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.20] ECC Decision (06)01: The harmonised utilisation of the bands 1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems, Approved 24 March 2006, Amended 8 March 2019. .
- [i.21] 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.22] 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.23] 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.24] 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.25] Commission Implementing Decision (EU) 2020/590 of 24 April 2020 amending Decision (EU) 2019/784 as regards an update of relevant technical conditions applicable to the 24,25-27,5 GHz frequency band.
- [i.26] ECC Decision 18(06): "Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24,25 - 27,5 GHz", Approved 06 July 2018, Last amended 20 November 2020.
- [i.27] 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.28] ETSI TR 137 941 (V15.3.0): "Universal Mobile Telecommunications System (UMTS); LTE; 5G; Radio Frequency (RF) conformance testing background for radiated Base Station (BS) requirements (3GPP TR 37.941 version 15.3.0 Release 15)".

[i.29] ETSI TR 103 877 (V1.1.1): "Task Force for European Standards for IMT-2000 (MSG); Technical Parameter selection in EN 301 908 Base Station (BS) Harmonised standards".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

active transmitter unit: transmitter unit which is on, and has the ability to send modulated data streams, that are parallel and distinct to those sent from other transmitter units, to an *antenna connector* or to one or more *TAB connectors*

antenna connector: connector at the conducted interface of the *BS type 1-C*

Base Station RF Bandwidth: RF bandwidth in which a base station transmits and/or receives single or multiple carrier(s) within a supported *operating band*

NOTE: In single carrier operation, the *Base Station RF Bandwidth* is equal to the *BS channel bandwidth*.

Base Station RF Bandwidth edge: frequency of one of the edges of the *Base Station RF Bandwidth*

basic limit: emissions limit relating to the power supplied by a single transmitter to a single antenna transmission line in Recommendation ITU-R SM.329-12 [i.4] used for the formulation of unwanted emission requirements for FR1

beam: main lobe of the radiation pattern of an *antenna array*

NOTE: For certain BS *antenna array*, there may be more than one *beam*.

beam centre direction: direction equal to the geometric centre of the half-power contour of the *beam*

beam direction pair: data set consisting of the *beam centre direction* and the related *beam peak direction*

beam peak direction: intended direction for maximum EIRP

beamwidth: *beam* which has a half-power contour that is essentially elliptical, the half-power beamwidths in the two pattern cuts that respectively contain the major and minor axis of the ellipse

BS channel bandwidth: RF bandwidth supporting a single NR RF carrier with the *transmission bandwidth* configured in the uplink or downlink

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

NOTE 2: The BS can transmit to and/or receive from one or more UE bandwidth parts that are less than or equal to the BS *transmission bandwidth* configuration, in any part of the BS *transmission bandwidth* configuration.

BS class: classification of BS according to its intended use

NOTE: There are three *BS classes* in the present document: *wide area Base Station*, *medium range Base Station* and *local Area Base Station*

BS receiver: composite receiver function of a BS receiving in an *operating band*

BS type 1-C: NR base station operating at FR1 with requirements set consisting only of conducted requirements defined at individual *antenna connectors*

BS type 1-H: NR base station operating at FR1 with a *requirement set* consisting of conducted requirements defined for a group of *TAB connectors* and OTA requirements defined at RIB

BS type 1-O: NR base station operating at FR1 with a *requirement set* consisting only of OTA requirements defined at the RIB

BS type 2-O: NR base station operating at FR2 with a *requirement set* consisting only of OTA requirements defined at the RIB

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

carrier aggregation configuration: a set of one or more *operating bands* across which the BS aggregates carriers with a specific set of technical requirements

channel edge: lowest or highest frequency of a carrier, separated by the *BS channel bandwidth*

co-location test antenna: practical passive antenna that is used for conformance testing of the co-location requirements

NOTE: *Co-Location Test Antenna (CLTA)* is described in clause 4.12.2 in ETSI TS 138 141-2 [2].

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

contiguous spectrum: spectrum consisting of a contiguous block of spectrum with no *sub-block gap(s)*

downlink operating band: part of the (FDD) *operating band* designated for downlink

equivalent isotropic radiated power: equivalent power radiated from an isotropic directivity device producing the same field intensity at a point of observation as the field intensity radiated in the direction of the same point of observation by the discussed device

NOTE: Isotropic directivity is equal in all directions (0 dBi).

equivalent isotropic sensitivity: sensitivity for an isotropic directivity device equivalent to the sensitivity of the BS exposed to an incoming wave from a defined AoA

NOTE 1: The sensitivity is the minimum received power level at which a RAT specific requirement is met.

NOTE 2: Isotropic directivity is equal in all directions (0 dBi).

fractional bandwidth: fractional bandwidth FBW is defined in percent as $FBW = 200 \cdot \frac{F_{FBW_{high}} - F_{FBW_{low}}}{F_{FBW_{high}} + F_{FBW_{low}}} \%$

FR1 OTA REFSENS RoAoA: RoAoA determined by the contour defined by the points at which the achieved EIS is 3 dB more than the achieved EIS in the reference direction in FR1

NOTE: This contour will be related to the average element/sub-array radiation pattern 3 dB *beamwidth*.

FR2 OTA REFSENS RoAoA: RoAoA within which the reference sensitivity is achieved in FR2

highest carrier: carrier with the highest carrier frequency transmitted/received in a specified frequency band

inter-band gap: frequency gap between two supported consecutive *operating bands*

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*

inter RF Bandwidth gap: frequency gap between two consecutive *Base Station RF Bandwidths* that are placed within two supported *operating bands*

local area Base Station: Base Stations characterized by requirements derived from picocell scenarios with a BS to UE minimum coupling loss equal to 45 dB

lowest carrier: carrier with the lowest carrier frequency transmitted/received in a specified frequency band

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

maximum carrier output power: mean power level measured per carrier at the indicated interface, during the *transmitter ON period* in a specified reference condition

maximum carrier TRP: mean power level measured per RIB during the *transmitter ON period* for a specific carrier in a specified reference condition and corresponding to the *rated carrier TRP* ($P_{\text{rated,c,TRP}}$)

maximum radio bandwidth: frequency difference between the upper edge of the highest used carrier and the lower edge of the lowest used carrier

measurement bandwidth: RF bandwidth in which an emission level is specified

medium range Base Station: Base Stations characterized by requirements derived from micro cell scenarios with a BS to UE minimum coupling loss equal to 53 dB

minSENS: lowest EIS value for the OSDD's associated with OTA sensitivity requirement

minSENS RoAoA: *reference RoAoA* associated with the OSDD with the lowest EIS

multi-band connector: *antenna connector* of the *BS type 1-C* or *TAB connector* of the *BS type 1-H* associated with a transmitter or receiver that is characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different *operating band* than the other carrier(s) and where this different *operating band* is not a sub-band or superseding-band of another supported *operating band*

multi-band RIB: *operating band* specific RIB associated with a transmitter or receiver that is characterized by the ability to process two or more carriers in common active RF components simultaneously, where at least one carrier is configured at a different *operating band* than the other carrier(s) and where this different *operating band* is not a sub-band or superseding-band of another supported *operating band*

non-contiguous spectrum: spectrum consisting of two or more *sub-blocks* separated by *sub-block gap(s)*

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

NOTE: The *operating band(s)* for a BS is declared by the manufacturer according to the designations in tables 1-2 and 1-3.

OTA coverage range: common range of directions within which TX OTA requirements that are neither specified in the *OTA peak directions sets* nor as *TRP requirement* are intended to be met

OTA peak directions set: set(s) of *beam peak directions* within which certain TX OTA requirements are intended to be met, where all *OTA peak directions set(s)* are subsets of the *OTA coverage range*

NOTE: The *beam peak directions* are related to a corresponding contiguous range or discrete list of *beam centre directions* by the *beam direction pairs* included in the set.

OTA REFSENS RoAoA: RoAoA determined by the contour defined by the points at which the achieved EIS is 3 dB more than the achieved EIS in the reference direction

NOTE: This contour will be related to the average element/sub-array radiation pattern 3 dB *beamwidth*.

OTA sensitivity directions declaration: set of manufacturer declarations comprising at least one set of minimum EIS values (with *BS channel bandwidth*), and related directions over which the EIS applies

NOTE: All the directions apply to all the EIS values in an OSDD.

polarization match: condition that exists when a plane wave, incident upon an antenna from a given direction, has a polarization that is the same as the receiving polarization of the antenna in that direction

radiated interface boundary: *operating band* specific radiated requirements reference where the radiated requirements apply

NOTE: For requirements based on EIRP/EIS, the *radiated interface boundary* is associated to the far-field region.

rated beam EIRP: for a certain *beam* and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the base station is intended to radiate at the associated *beam peak direction* during the *transmitter ON period*

rated carrier output power: mean power level associated with a particular carrier the manufacturer has declared to be available at the indicated interface, during the *transmitter ON period* in a specified reference condition

rated carrier TRP: mean power level per carrier, for BS operating in single carrier, multi-carrier, or *carrier aggregation configurations* that the manufacturer has declared to be available at the RIB during the *transmitter ON period*

rated total output power: mean power level associated with a particular *operating band* the manufacturer has declared to be available at the indicated interface, during the *transmitter ON period* in a specified reference condition

rated transmitter TRP: mean power level declared by the manufacturer to be available at the RIB during the *transmitter ON period*

receiver target: AoA in which reception is performed

NOTE: Only for *BS types 1-H*, *BS type 1-O* and *BS types 2-O*.

receiver target redirection range: union of all the *sensitivity RoAoA* achievable through redirecting the *receiver target* related to a particular OSDD

receiver target reference direction: target direction inside the *OTA sensitivity directions declaration*

NOTE: For an OSDD without *receiver target redirection range*, this is a direction inside the *sensitivity RoAoA*.

reference beam direction pair: *beam direction pair*, including *reference beam centre direction* and *reference beam peak direction* where the *reference beam peak direction* is the direction for the intended maximum EIRP within the *OTA peak directions set*

reference RoAoA: *sensitivity RoAoA* associated with the *receiver target reference direction* for each OSDD

requirement set: one of the NR base station requirement's set as defined for *BS type 1-C*, *BS type 1-H*, *BS type 1-O*, and *BS type 2-O*

sensitivity RoAoA: *RoAoA* within the *OTA sensitivity directions declaration*, within which the EIS(s) of an OSDD is intended to be achieved at any instance of time for a specific BS direction setting

single-band connector: *antenna connector* of the *BS type 1-C* or *TAB connector* of the *BS type 1-H* supporting operation either in a single *operating band* only, or in multiple *operating bands* but does not meet the conditions for a *multi-band connector*

single-band RIB: *operating band* specific RIB supporting operation either in a single *operating band* only, or in multiple *operating bands* but does not meet the conditions for a *multi-band RIB*

sub-block: one contiguous allocated block of spectrum for transmission and reception by the same base station

NOTE: There may be multiple instances of *sub-blocks* within a *Base Station RF Bandwidth*.

sub-block gap: frequency gap between two consecutive *sub-blocks* within a *Base Station RF Bandwidth*, where the RF requirements in the gap are based on co-existence for un-coordinated operation

TAB connector: *transceiver array boundary connector*

TAB connector RX min cell group: *operating band* specific group of *TAB connectors* responsible for receiving a cell, associated with the intended minimum number of cells, N_{cells}

TAB connector TX min cell group: *operating band* specific group of *TAB connectors* responsible for transmitting a cell, associated with the intended minimum number of cells, N_{cells}

total radiated power: total power radiated by the antenna

NOTE: The *total radiated power* is the power radiating in all direction for two orthogonal polarizations. *Total radiated power* is defined in both the near-field region and the far-field region.

transceiver array boundary: conducted interface between the transceiver unit array and the composite antenna

transmission bandwidth: RF Bandwidth of an instantaneous transmission from a UE or BS, expressed in resource block units

NOTE: It is used as a frequency reference point for both transmitter and receiver requirements.

transmitter OFF period: time period during which the BS transmitter is not allowed to transmit

transmitter ON period: time period during which the BS transmitter is transmitting data and/or reference symbols

transmitter transient period: time period during which the transmitter is changing from the OFF period to the ON period or vice versa

uplink operating band: part of the (FDD) *operating band* designated for uplink

wide area Base Station: Base Stations characterized by requirements derived from Macro Cell scenarios with a BS to UE minimum coupling loss equal to 70 dB

3.2 Symbols

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

$BeW_{\varphi, \text{REFSENS}}$	The <i>beamwidth</i> equivalent to the OTA REFSENS RoAoA in the φ -axis in degrees, applicable for FR1 only
BW_{Channel}	<i>BS channel bandwidth</i>
BW_{Config}	<i>Transmission bandwidth</i> configuration, expressed in MHz, where $BW_{\text{Config}} = N_{\text{RB}} \times \text{SCS} \times 12 \text{ kHz}$
B_{RFBW}	Maximum Base Station RF bandwidth located at the bottom of the supported frequency range in the operating band
Δf	Separation between the <i>channel edge</i> frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency, expressed in MHz
Δf_{max}	$f_{\text{offset}_{\text{max}}}$ minus half of the bandwidth of the measuring filter, expressed in MHz
Δf_{OBUE}	Maximum offset of the <i>operating band</i> unwanted emissions mask from the downlink <i>operating band edge</i> , expressed in MHz
$\Delta_{\text{FR2_REFSENS}}$	Offset applied to the FR2 OTA reference sensitivity depending on the AoA
Δf_{OOB}	Maximum offset of the out-of-band boundary from the uplink <i>operating band edge</i> , expressed in MHz
Δ_{minSENS}	Difference between conducted reference sensitivity and EIS_{minsens} and calculated in clause 4.3.1.6
$\Delta_{\text{OTAREFSNS}}$	Parameter calculated in clause 4.3.1.6 which represents the difference between conducted reference sensitivity and radiated reference sensitivity.
Δ_{sample}	The difference between the power measurements under normal and extreme test environments, $P_{\text{max, sample, nom}} - P_{\text{max, sample, ext}}$
EIS_{minsens}	The EIS value for the <i>minSENS</i> RoAoA
EIS_{REFSENS}	OTA reference sensitivity EIS value
$EIS_{\text{REFSENS_50M}}$	OTA reference sensitivity basis level for FR2 based on a reference measurement channel with 50 MHz <i>BS channel bandwidth</i>
F_{filter}	Filter centre frequency
F_{FBWhigh}	Highest frequency within the <i>operating band</i> , for which <i>fractional bandwidth</i> is supported, expressed in MHz
F_{FBWlow}	Lowest frequency within the <i>operating band</i> , for which <i>fractional bandwidth</i> is supported, expressed in MHz
f_{offset}	Separation between the <i>channel edge</i> frequency and the centre of the measuring filter, expressed in MHz
$f_{\text{offset}_{\text{max}}}$	The offset to the frequency Δf_{OBUE} outside the downlink <i>operating band</i> , expressed in MHz
$F_{\text{DL_low}}$	The lowest frequency of the downlink <i>operating band</i> , expressed in MHz
$F_{\text{DL_high}}$	The highest frequency of the downlink <i>operating band</i> , expressed in MHz
$F_{\text{UL_low}}$	The lowest frequency of the uplink <i>operating band</i> , expressed in MHz
$F_{\text{UL_high}}$	The highest frequency of the uplink <i>operating band</i> , expressed in MHz
I_{quant}	E-Node B internal logical interface between the implementation specific O&M function and the RET antennas and TMAs control unit function of the BS
M_{RFBW}	Maximum Base Station RF bandwidth located in the middle of the supported frequency range in the operating band
N_{cells}	Minimum number of cells that can be transmitted by an <i>BS type I-H</i> in a particular <i>operating band</i>
N_{RB}	<i>Transmission bandwidth</i> configuration, expressed in resource blocks
$N_{\text{TXU, active}}$	The number of <i>active transmitter units</i>
$N_{\text{TXU, counted}}$	The number of <i>active transmitter units</i> that are taken into account for conducted TX output power limit and for unwanted TX emissions scaling

$N_{\text{TXU, counted per cell}}$	The number of <i>active transmitter units</i> that are taken into account for conducted TX emissions scaling per cell
$P_{\text{max, c, AC}}$	<i>Maximum carrier output power measured per antenna connector</i>
$P_{\text{max, c, EIRP}}$	The maximum carrier EIRP when the BS is configured at the maximum <i>rated carrier TRP</i> ($P_{\text{rated, c, TRP}}$)
$P_{\text{max, c, EIRP, extreme}}$	The maximum carrier EIRP when the AAS BS is configured at the <i>rated carrier TRP</i> ($P_{\text{rated, c, TRP}}$) under extreme test environment, either measured directly or calculated
$P_{\text{max, c, TABC}}$	<i>The maximum carrier output power per TAB connector</i>
$P_{\text{max, sample, nom}}$	The measured sample power in the environmental enclosure when the BS is configured at the <i>rated carrier TRP</i> ($P_{\text{rated, c, TRP}}$), under normal test environment
$P_{\text{max, sample, ext}}$	The measured sample power in the environmental enclosure when the BS is configured at the <i>rated carrier TRP</i> ($P_{\text{rated, c, TRP}}$), under extreme test environment
$P_{\text{rated, c, AC}}$	<i>The rated carrier output power per antenna connector</i>
$P_{\text{rated, c, sys}}$	The sum of $P_{\text{rated, c, TABC}}$ for all <i>TAB connectors</i> for a single carrier
$P_{\text{rated, c, FBWhigh}}$	The rated carrier EIRP for the higher frequency range within the <i>operating band</i> , for which <i>fractional bandwidth</i> is supported.
$P_{\text{rated, c, FBWlow}}$	The rated carrier EIRP for the lower frequency range within the <i>operating band</i> , for which <i>fractional bandwidth</i> is supported
$P_{\text{rated, c, TABC}}$	<i>The rated carrier output power per TAB connector</i>
$P_{\text{rated, c, TRP}}$	<i>Rated carrier TRP per RIB</i>
$P_{\text{rated, t, AC}}$	<i>The rated total output power at the antenna connector</i>
$P_{\text{rated, t, TABC}}$	<i>The rated total output power at TAB connector</i>
$P_{\text{rated, t, TRP}}$	<i>Rated transmitter TRP per RIB</i>
P_{REFSENS}	Conducted Reference Sensitivity power level
T_{RFBW}	Maximum Base Station RF bandwidth located at the top of the supported frequency range in the operating band
$\text{TRP}_{\text{Estimate}}$	Numerically approximated TRP
W_{gap}	<i>Sub-block gap or Inter RF Bandwidth gap size</i>

3.3 Abbreviations

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

ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
BS	Base Station
BW	Bandwidth
CA	Carrier Aggregation
CACLR	Cumulative ACLR
CDMA	Code Division Multiple Access
CLTA	Co-Location Test Antenna
CW	Continuous Wave
DC	Direct Current
DL	Downlink
DTT	Digital Terrestrial Television
EC	European Commission
EESS	Earth Exploration Satellite Service
EFTA	European Foreign Trade Association
EG	ETSI Guide
EIRP	Equivalent Isotropic Radiated Power
EIS	Equivalent Isotropic Sensitivity
EN	European Standard
EU	European Union
EUT	Equipment Under Test
E-UTRA	Evolved UTRA
FBW	Fractional Bandwidth
FDD	Frequency Division Duplex
FR1	Frequency Range 1
FR2	Frequency Range 2
FRC	Fixed Reference Channel
FS	Fixed Services

FSS	Fixed Satellite Services
GSM	Global System for Mobile communications
HARQ	Hybrid Automatic Repeat-reQuest
IMT	International Mobile Telecommunications
ITU-R	Radiocommunication sector of the International Telecommunication Union
MC	Multi-Carrier
MSG	Mobile Standards Group (ETSI TC)
MS	Mobile Station
MSR	Multi Standard Radio
NR	New Radio (also known as 5G)
NR-ARFCN	NR - Absolute Radio Frequency Channel Number
OBUE	Operating Band Unwanted Emissions
OSDD	OTA Sensitivity Directions Declaration
OTA	Over The Air
RAT	Radio Access Technology
RB	Resource Block
RDN	Radio Distribution Network
REFSENS	Reference Sensitivity
RET	Remote Electrical Tilt
RF	Radio Frequency
RIB	Radiated Interface Boundary
RMS	Root Mean Square (value)
RoAoA	Range of Angles of Arrival
RX	Receiver
SC	Single-Carrier
SCS	Sub-Carrier Spacing
SDL	Supplementary Downlink
TAB	Transceiver Array Boundary
TDD	Time Division Duplex
TR	Technical Report
TRP	Total Radiated Power
TS	Technical Specifications
TX	Transmitter
UE	User Equipment
UL	Uplink
UTRA	UMTS Terrestrial Radio Access

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.

The operational environmental profile shall at least contain all environmental conditions in the test environments referenced from the essential radio test suites in clause 5 of the present document.

4.2 Requirement set applicability

Table 4.2-1 provides a summary of the BS *requirement set* applicability, depending on the BS type, i.e. *BS type 1-C*, *BS type 1-H*, *BS type 1-O*, or *BS type 2-O*.

Table 4.2-1: Requirement set applicability

Requirement BS type	Requirement set (by clause)			
	1-C	1-H	1-O	2-O
BS output power	4.3.5	4.3.5		
Adjacent Channel Leakage power Ratio (ACLR)	4.3.3	4.3.3		
Operating band unwanted emissions	4.3.2	4.3.2		
Transmitter spurious emissions	4.3.4	4.3.4		
Transmitter intermodulation	4.3.6	4.3.6		
Reference sensitivity level	4.3.12	4.3.12		
ACS	4.3.11	4.3.11		
In-band blocking	4.3.8	4.3.8		
Out-of-band blocking	4.3.9	4.3.9		
Receiver spurious emissions	4.3.7	4.3.7		
Receiver intermodulation	4.3.10	4.3.10		
OTA operating band unwanted emissions			4.3.13	4.3.13
OTA ACLR			4.3.14	4.3.14
OTA transmitter spurious emissions			4.3.15	4.3.15
Radiated transmit power		4.3.16	4.3.16	4.3.16
OTA Base Station output power			4.3.17	4.3.17
OTA transmitter intermodulation			4.3.18	(note 1)
OTA receiver spurious emissions			4.3.19	4.3.19
OTA In-band blocking			4.3.20	4.3.20
OTA out-of-band blocking			4.3.21	4.3.21
OTA receiver intermodulation			4.3.22	4.3.22
OTA ACS			4.3.23	4.3.23
OTA sensitivity		4.3.24	4.3.24	(note 2)
OTA reference sensitivity			4.3.25	4.3.25
NOTE 1: Due to high isolation between co-located base stations at FR2 frequencies there is no relevance for a transmitter intermodulation requirement for BS operating at FR2 bands specified by the <i>requirement set</i> for BS type 2-O.				
NOTE 2: For BS type 2-O there are no equivalent conducted requirements to be translated to the radiated requirements, and a certain minimum level of beam forming gain is required. As such it is not necessary to have both OTA sensitivity and the OTA reference sensitivity requirements. Hence there is only one sensitivity requirement defined for FR2, which is used as OTA reference sensitivity.				

4.3 Conformance requirements

4.3.1 Introduction

4.3.1.1 General

The requirements in the present document are based on the assumption that the *operating bands* (see table 1-2) could be shared between systems of the IMT family (for band 3 and 8 also GSM) or systems having compatible characteristics.

In many cases, requirements are defined separately for FR1 and for FR2.

To meet the essential requirement under article 3.2 of Directive 2014/53/EU [i.1] for NR Base Stations (BS), a set of essential parameters in addition to those in ETSI EN 301 908-1 [i.6] have been identified. Tables 4.3.1.1-1 and 4.3.1.1-2 provide a cross reference between these essential parameters and the corresponding technical requirements for equipment within the scope of the present document.

Table 4.3.1.1-1: Cross references for conducted requirements and test suites

Essential parameter	Corresponding conducted requirement	Corresponding conducted test suite
Transmitter spectrum mask	4.3.2 Operating band unwanted emissions	5.3.2
Transmitter unwanted emissions in the out-of-band domain	4.3.3 Adjacent Channel Leakage power Ratio (ACLR)	5.3.3
Transmitter unwanted emissions in the spurious domain	4.3.4 Transmitter spurious emissions	5.3.4
Transmitter power accuracy	4.3.5 Base Station output power	5.3.5
Transmitter intermodulation attenuation	4.3.6 Transmit intermodulation	5.3.6
Receiver unwanted emissions in the spurious domain	4.3.7 Receiver spurious emissions	5.3.7
Receiver blocking	4.3.8 In-band blocking	5.3.8
Receiver desensitization	4.3.9 Out-of-band blocking	5.3.9
Receiver radio-frequency intermodulation	4.3.10 Receiver intermodulation	5.3.10
Receiver adjacent signal selectivity	4.3.11 Adjacent Channel Selectivity (ACS)	5.3.11
Receiver sensitivity	4.3.12 Reference sensitivity level	5.3.12

Table 4.3.1.1-2: Cross references for radiated requirements and test suites

Essential parameter	Corresponding radiated requirement	Corresponding radiated test suite
Transmitter spectrum mask	4.3.13 OTA operating band unwanted emissions	5.3.13
Transmitter unwanted emissions in the out-of-band domain	4.3.14 OTA Adjacent Channel Leakage power Ratio (ACLR)	5.3.14
Transmitter unwanted emissions in the spurious domain	4.3.15 OTA transmitter spurious emissions	5.3.15
Transmitter power accuracy	4.3.16 Radiated transmit power 4.3.17 OTA Base Station output power	5.3.16 5.3.17
Transmitter intermodulation attenuation	4.3.18 OTA transmitter intermodulation	5.3.18
Receiver unwanted emissions in the spurious domain	4.3.19 OTA receiver spurious emissions	5.3.19
Receiver blocking	4.3.20 OTA In-band blocking	5.3.20
Receiver desensitization	4.3.21 OTA Out-of-band blocking	5.3.21
Receiver radio-frequency intermodulation	4.3.22 OTA receiver intermodulation	5.3.22
Receiver adjacent signal selectivity	4.3.23 OTA ACS	5.3.23
Receiver sensitivity	4.3.24 OTA sensitivity 4.3.25 OTA Reference sensitivity	5.3.24 5.3.25

- For each BS Type and associated set of requirements, the limits are identified based on following information included in the technical documentation of the radio equipment. The intended *BS class* of the base station under test, according to:
 - clause 4.3 in ETSI TS 138 141-1 [1] for *BS type 1-C* and *BS type 1-H*; or
 - clause 4.3 in ETSI TS 138 141-2 [2] for *BS type 1-O* and *BS type 2-O*.
- The supported RF configurations, according to:
 - clauses 4.6, D.1 to D.43 in ETSI TS 138 141-1 [1], for the conducted requirements of the *BS type 1-H*;
 - clauses 4.6, D.1 to D.63 in ETSI TS 138 141-2 [2] for the radiated requirements of the *BS type 1-H*, *BS type 1-O* and *BS type 2-O*.

The technical requirements in the present document apply for the *BS class* and the supported *operating band(s)*, as outlined for each requirement. For a Base Station supporting more than one *operating band*, compliance to each technical requirement in clause 4 shall be fulfilled for each *operating band*.

The technical requirements also apply to the BS configurations described in clauses C.1, C.2.3, C.3, D.2 and D.4 of the present document.

All the parameters declared by the manufacturer shall correspond to the intended use of the equipment. Throughout the present document there are such references to manufacturer declarations. They are referred as D.x and will be coded in the following manner, in order to distinguish their origin:

- Parameters in the form D.x in clauses 4.3.2 to 4.3.12, 5.3.2 to 5.3.12 and annex C are found in table 4.6-1 in ETSI TS 138 141-1 [1].
- Parameters in the form D.x in clauses 4.3.13 to 4.3.25, 5.3.13 to 5.3.25 and annex D are found in table 4.6-1 in ETSI TS 138 141-2 [2].

4.3.1.2 Conducted transmitter requirements

Reference points for conducted transmitter requirements are described in clauses C.1.1 and C.2.1 and in clause 4.2 in ETSI TS 138 141-1 [1].

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions in Recommendation ITU-R SM.329-12 [i.4]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *BS channel bandwidth* resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. The out-of-band emissions requirement for the BS transmitter is specified both in terms of Adjacent Channel Leakage Ratio (ACLR) and Operating Band Unwanted Emissions (OBUE).

The maximum offset of the OBUE mask from the *operating band* edge is Δf_{OBUE} . The OBUE define all unwanted emissions in each supported *downlink operating band* plus the frequency ranges Δf_{OBUE} above and Δf_{OBUE} below each band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

For *BS type 1-H* the unwanted emission requirements are applied per *TAB connector TX min cell groups* for all the RF configurations supported by the BS. The emissions *basic limits* and respective scaling are defined in each relevant clause.

NOTE 1: The term "scaling" (i.e. of a *basic limit*) refers to how the limit is derived from the *basic limit* by adding X (dB) to scale with the number of active transmitters, $X = 10\log_{10}(N_{\text{TXU,countedpercell}})$.

For *BS type 1-H* the number of *active transmitter units* that are considered when calculating the emissions limit ($N_{\text{TXU,counted}}$) is calculated as follows:

- $N_{\text{TXU,counted}} = \min(N_{\text{TXU,active}}, 8 \cdot N_{\text{cells}})$

Further:

- $N_{\text{TXU,countedpercell}} = N_{\text{TXU,counted}}/N_{\text{cells}}$
- $N_{\text{TXU,countedpercell}}$ is used for scaling the *basic limits*.

NOTE 2: $N_{\text{TXU,active}}$ depends on the actual number of *active transmitter units* and is independent of N_{cells} .

For *BS Type 1-H*, every *TAB connector* supporting transmission in an *operating band* shall map to one *TAB connector TX min cell group*, where mapping of *TAB connectors* to cells is implementation dependent.

4.3.1.3 Conducted receiver requirements

Reference points for conducted receiver requirements are described in clauses C.1.2 and C.2.2 and clause 4.2 in ETSI TS 138 141-1 [1].

Conducted receiver characteristics are specified at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*, with a full complement of transceivers for the configuration in normal operation.

The following arrangements apply for conducted receiver requirements in clause 4.3:

- Requirements apply during the BS receive period.
- Requirements shall be met for any transmitter setting.

- For FDD operation the requirements shall be met with the transmitter unit(s) transmitting data and/or reference symbols.
- Throughput requirements defined for the receiver characteristics do not assume HARQ retransmissions.
- When BS is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.
- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*, and the positive offsets of the interfering signal apply relative to the upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.

4.3.1.4 Conducted requirements for BS capable of multi-band operation

For *multi-band connectors*, the conducted limits in clause 4 shall apply separately to each supported *operating band*. For some conducted limits, it is explicitly stated that specific additions or exclusions to the requirement apply at *multi-band connector(s)*, as detailed in the requirement clause.

For *BS type I-C* capable of multi-band operation, various structures in terms of combinations of different transmitter and receiver implementations (multi-band or single band) with mapping of transceivers to one or more *antenna connectors* for *BS type I-C* or *TAB connectors* for *BS type I-H* in different ways are possible. For *multi-band connector(s)* the exclusions or provisions for multi-band shall apply. For *single-band antenna connector(s)*, the following shall apply:

- Single-band transmitter spurious emissions, *operating band* unwanted emissions, ACLR, transmitter intermodulation and receiver spurious emissions requirements shall apply to this *antenna connector* that is mapped to single-band.
- If the BS is configured for single-band operation, single-band requirements shall apply to this *antenna connector* configured for single-band operation and no exclusions or provisions for multi-band capable BS are applicable. Single-band requirements are tested separately at the *antenna connector* configured for single-band operation, with all other *antenna connectors* terminated.

A *BS type I-H* may be capable of supporting operation in multiple *operating bands* with one of the following implementations of *TAB connectors* in the *transceiver array boundary*:

- All *TAB connectors* are *single-band connectors*:
 - Different sets of *single-band connectors* support different *operating bands*, but each *TAB connector* supports only operation in one single *operating band*.
 - Sets of *single-band connectors* support operation in multiple *operating bands* with some *single-band connectors* supporting more than one *operating band*.
- All *TAB connectors* are *multi-band connectors*.
- A combination of single-band sets and multi-band sets of *TAB connectors* provides support of the type *BS type I-H* capability of operation in multiple *operating bands*.

All conducted requirements specified for an *operating band* shall apply only to the set of *TAB connectors* supporting that *operating band*.

In the case of an *operating band* being supported only by *single-band connectors* in a *TAB connector TX min cell group* or a *TAB connector RX min cell group*, *single-band requirements* shall apply to that set of *TAB connectors*.

NOTE 1: Each supported *operating band* needs to be enabled separately during conformance testing on *single band TAB connectors*.

In the case of an *operating band* being supported only by *multi-band connectors* supporting the same *operating band* combination in a *TAB connector TX min cell group* or a *TAB connector RX min cell group*, *multi-band requirements* shall apply to that set of *TAB connectors*.

For *multi-band connectors* supporting the bands for TDD, the RF requirements in the present specification assume no simultaneous uplink and downlink occur between the bands.

NOTE 2: The case of an *operating band* being supported by both *multi-band connectors* and *single-band connectors* in a *TAB connector TX min cell group* or a *TAB connector RX min cell group* is not covered by the present document.

NOTE 3: The case of an *operating band* being supported by *multi-band connectors* which are not all supporting the same *operating band* combination in a *TAB connector TX min cell group* or a *TAB connector RX min cell group* is not covered by the present document.

NOTE 4: The requirements for *multi-band connectors* supporting bands for both FDD and TDD are not covered by the present document.

4.3.1.5 Radiated transmitter requirements

Reference points for radiated transmitter requirements are described in clause D.1 and in clause 4.2 in ETSI TS 138 141-2 [2].

OTA unwanted emissions consist of so-called out-of-band emissions and spurious emissions according to ITU definitions in Recommendation ITU-R SM.329-12 [i.4]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *BS channel bandwidth* resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.

The OTA out-of-band emissions requirement for the *BS type 1-O* and *BS type 2-O* transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and *Operating Band Unwanted Emissions* (OBUE). The OTA *Operating band* unwanted emissions define all unwanted emissions in each supported *downlink operating band* plus the frequency ranges Δf_{OBUE} above and Δf_{OBUE} below each band. OTA Unwanted emissions outside of this frequency range are limited by an OTA spurious emissions requirement.

The maximum offset of the *operating band* unwanted emissions mask from the *operating band* edge is Δf_{OBUE} .

The OTA unwanted emission requirements are applied per cell for all the configurations.

4.3.1.6 Radiated receiver requirements

Reference points for radiated receiver requirements are described in clause D.2 and in clause 4.2 in ETSI TS 138 141-2 [2].

The following arrangements apply for radiated receiver characteristics requirements:

- Requirements apply during the BS receive period.
- Requirements shall be met for any transmitter setting.
- For FDD operation the requirements shall be met with the transmitter unit(s) transmitting data and/or reference symbols.
- Throughput requirements defined for the radiated receiver characteristics do not assume HARQ retransmissions.
- When BS is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.
- For ACS, blocking and intermodulation characteristics, the negative offsets of the interfering signal apply relative to the lower *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*, and the positive offsets of the interfering signal apply relative to the upper *Base Station RF Bandwidth* edge or *sub-block* edge inside a *sub-block gap*.

Each radiated requirement, except OTA receiver spurious emissions, shall apply over the RoAoA specified.

For FR1 radiated requirements which apply over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{\text{OTAREFSENS}} = 44,1 - 10 \times \log_{10}(\text{BeW}_{\theta,\text{REFSENS}} \times \text{BeW}_{\phi,\text{REFSENS}}) \text{ (dB) for the reference direction;}$$

and

$$\Delta_{\text{OTAREFSENS}} = 41,1 - 10 \times \log_{10}(\text{BeW}_{\theta,\text{REFSENS}} \times \text{BeW}_{\phi,\text{REFSENS}}) \text{ (dB) for all other directions.}$$

For requirements which apply over the *minSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{\text{minSENS}} = P_{\text{REFSENS}} - \text{EIS}_{\text{minSENS}} \text{ (dB)}$$

For FR2 requirements which apply over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

$$\Delta_{\text{FR2_REFSENS}} = -3 \text{ dB for the reference direction;}$$

and

$$\Delta_{\text{FR2_REFSENS}} = 0 \text{ dB for all other directions.}$$

4.3.1.7 Radiated requirements for BS capable of multi-band operation

For *multi-band RIB*, the radiated limits in clause 4 apply separately to each supported *operating band*. For some radiated limits, it is explicitly stated that specific additions or exclusions apply at *multi-band RIB(s)* as detailed in the requirement clause.

BS type I-O may be capable of supporting operation in multiple *operating bands* with one of the following implementations at the *radiated interface boundary*:

- All RIBs are *single-band RIBs*.
- All RIBs are *multi-band RIBs*.
- A combination of *single-band RIBs* and *multi-band RIBs* provides support of the *BS type I-O* capability of operation in multiple *operating bands*.

For *multi-band RIBs* supporting the bands for TDD, the radiated requirements in the present specification assume no simultaneous uplink and downlink occur between the bands.

NOTE: The radiated requirements for *multi-band RIBs* supporting bands for both FDD and TDD are not covered by the present document.

4.3.1.8 Additional BS conformance to other standards

For a *BS type I-C* additionally conforming to ETSI EN 301 908-18 [4], conformance with the technical requirements listed in table 4.3.1.1-1 can equally be demonstrated through the corresponding technical requirements and test suites in ETSI EN 301 908-18 [4], as listed in table 4.3.1.8-1. When conformance is demonstrated through the corresponding test suites in ETSI EN 301 908-18 [4] for these technical requirements, the test suites in the present document need not be performed.

Table 4.3.1.8-1: Alternative technical requirements and test suites in ETSI EN 301 908-18 [4] that can equally be used for demonstrating conducted *BS Type-1C* conformance

Conducted requirement in the present document	Corresponding conducted requirements in ETSI EN 301 908-18 [4]	Corresponding conducted test suites in ETSI EN 301 908-18 [4]
4.3.2 Operating band unwanted emissions	4.2.2	5.3.1
4.3.3 ACLR	4.2.3	5.3.2
4.3.4 Transmitter spurious emissions	4.2.4	5.3.3
4.3.5 Base station output power	4.2.5	5.3.4
4.3.6 Transmit intermodulation	4.2.6	5.3.5
4.3.7 Receiver spurious emissions	4.2.7	5.3.6
4.3.8 In-band blocking	4.2.8	5.3.7
4.3.9 Out-of-band blocking	4.2.9	5.3.8
4.3.10 Receiver intermodulation	4.2.10	5.3.9
4.3.11 ACS	4.2.11	5.3.10
4.3.12 Reference sensitivity level	4.2.12	5.3.11

For a *BS type 1-H* additionally conforming to ETSI EN 301 908-23 [5], conformance with the technical requirements listed in table 4.3.1.1-1 can equally be demonstrated through the corresponding technical requirements and test suites in ETSI EN 301 908-23 [5], as listed in tables 4.3.1.8-2 and 4.3.1.8-3. When conformance is demonstrated through the corresponding test suites in ETSI EN 301 908-23 [5] for these technical requirements, the test suites in the present document need not be performed.

Table 4.3.1.8-2: Alternative technical requirements and test suites in ETSI EN 301 908-23 [5] that can equally be used for demonstrating conducted *BS Type 1-H* conformance

Conducted requirement in the present document	Corresponding conducted requirements in ETSI EN 301 908-23 [5]	Corresponding conducted test suites in ETSI EN 301 908-23 [5]
4.3.2 Operating band unwanted emissions	4.3.2	5.3.2
4.3.3 ACLR	4.3.4	5.3.4
4.3.4 Transmitter spurious emissions	4.3.5	5.3.5
4.3.5 Base station output power	4.3.6	5.3.6
4.3.6 Transmit intermodulation	4.3.7	5.3.7
4.3.7 Receiver spurious emissions	4.3.8	5.3.8
4.3.8 In-band blocking	4.3.9	5.3.9
4.3.9 Out-of-band blocking	4.3.9	5.3.9
4.3.10 Receiver intermodulation	4.3.10	5.3.10
4.3.11 ACS	4.3.11	5.3.11
4.3.12 Reference sensitivity level	4.3.12	5.3.12

Table 4.3.1.8-3: Alternative technical requirements and test suites in ETSI EN 301 908-23 [5] that can equally be used for demonstrating radiated *BS type 1-H* conformance

Radiated requirement in the present document	Corresponding radiated requirements in ETSI EN 301 908-23 [5]	Corresponding radiated test suites in ETSI EN 301 908-23 [5]
4.3.16 Radiated transmit power	4.3.17	5.3.17
4.3.25 OTA Reference sensitivity	4.2.25	5.3.25

For a *BS type 1-O* additionally conforming to ETSI EN 301 908-23 [5], conformance with the technical requirements listed in table 4.3.1.1-2 can equally be demonstrated through the corresponding technical requirements and test suites in ETSI EN 301 908-23 [5], as listed in table 4.3.1.8-4. When conformance is demonstrated through the corresponding test suites in ETSI EN 301 908-23 [5] for these technical requirements, the test suites in the present document need not be performed.

Table 4.3.1.8-4: Alternative technical requirements and test suites in ETSI EN 301 908-23 [5] that can equally be used for demonstrating radiated BS type 1-O conformance

Radiated requirement in the present document	Corresponding radiated requirements in ETSI EN 301 908-23 [5]	Corresponding radiated test suites in ETSI EN 301 908-23 [5]
4.3.13 OTA Operating band unwanted emissions	4.3.13	5.3.13
4.3.14 OTA ACLR	4.3.15	5.3.15
4.3.15 OTA Transmitter spurious emissions	4.3.16	5.3.16
4.3.16 Radiated transmit power	4.3.17	5.3.17
4.3.17 OTA Base station output power	4.3.18	5.3.18
4.3.18 OTA Transmit intermodulation	4.3.19	5.3.19
4.3.19 OTA Receiver spurious emissions	4.3.20	5.3.20
4.3.20 OTA In-band blocking	4.3.21	5.3.21
4.3.21 OTA Out-of-band blocking	4.3.21	5.3.21
4.3.22 OTA Receiver intermodulation	4.3.22	5.3.22
4.3.23 OTA ACS	4.3.23	5.3.23
4.3.24 OTA sensitivity	4.3.24	5.3.24
4.3.25 OTA Reference sensitivity	4.3.25	5.3.25

NOTE: Additional requirements arising from EC/CEPT spectrum regulatory framework that apply to specific equipment applicable to specific cases in certain countries and/or in certain geographical areas are addressed in ETSI TS 103 807 [i.9].

4.3.2 Operating band unwanted emissions

4.3.2.1 Definition and applicability

The *Operating Band Unwanted Emission* (OBUE) limits in FR1 are defined from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band* up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. In addition, for a BS operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block* gap. In addition, for a BS operating in multiple bands, the requirements apply inside any *Inter RF Bandwidth gap*.

The values of Δf_{OBUE} are defined in table 4.3.2.1-1 for the NR bands (see table 1-2).

Table 4.3.2.1-1: Maximum offset of OBUE outside the downlink *operating band*

BS type	Operating band characteristics	Δf_{OBUE} (MHz)
BS type 1-C	$F_{\text{DL_high}} - F_{\text{DL_low}} \leq 200 \text{ MHz}$	10
	$200 \text{ MHz} < F_{\text{DL_high}} - F_{\text{DL_low}} \leq 900 \text{ MHz}$	40
BS type 1-H	$F_{\text{DL_high}} - F_{\text{DL_low}} < 100 \text{ MHz}$	10
	$100 \text{ MHz} \leq F_{\text{DL_high}} - F_{\text{DL_low}} \leq 900 \text{ MHz}$	40

NOTE: The notes in table 2-1 are specifying the applicable values for $F_{\text{DL_low}}$ and $F_{\text{DL_high}}$.

4.3.2.2 Limits

4.3.2.2.1 General

The *operating band* unwanted emission limits are specified in clauses 4.3.2.2.2 to 4.3.2.2.4, where:

- Δf is the separation between the *channel edge* frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.
- f_{offset} is the separation between the *channel edge* frequency and the centre of the measuring filter.
- $f_{\text{offset_max}}$ is the offset to the frequency Δf_{OBUE} outside the downlink *operating band*, where Δf_{OBUE} is defined in table 4.3.2.1-1.

- Δf_{\max} is equal to $f_{\text{offset}_{\max}}$ minus half of the bandwidth of the measuring filter.

Measurement filter is defined as in Recommendation ITU-R SM.329-12 [i.4], s4.1.

For a *multi-band connector* inside any *Inter RF Bandwidth gaps* with $W_{\text{gap}} < 2 \times \Delta f_{\text{OBUE}}$, a combined *basic limit* shall be applied which is the cumulative sum of the *basic limits* specified at the *Base Station RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The *basic limit* for *Base Station RF Bandwidth edge* is specified in clauses 4.3.2.2.2 to 4.3.2.2.4, where in this case:

- Δf is the separation between the *Base Station RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *Base Station RF Bandwidth edge*.
- f_{offset} is the separation between the *Base Station RF Bandwidth edge* frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\max}}$ is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.
- Δf_{\max} is equal to $f_{\text{offset}_{\max}}$ minus half of the bandwidth of the measuring filter.

For a *multi-band connector*, the *operating band* unwanted emission *basic limits* apply also in a supported *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported *operating band*. In this case, no cumulative *basic limit* is applied in the *inter-band gap* between a supported *downlink operating band* with carrier(s) transmitted and a supported *downlink operating band* without any carrier transmitted:

- In case the *inter-band gap* between a supported *downlink operating band* with carrier(s) transmitted and a supported *downlink operating band* without any carrier transmitted is less than $2 \times \Delta f_{\text{OBUE}}$, $f_{\text{offset}_{\max}}$ shall be the offset to the frequency Δf_{OBUE} MHz outside the outermost edges of the two supported *downlink operating bands* and the *operating band* unwanted emission *basic limit* of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both downlink bands.
- In other cases, the *operating band* unwanted emission *basic limits* of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δf_{\max}), shall apply from Δf_{OBUE} MHz below the lowest frequency, up to Δf_{OBUE} MHz above the highest frequency of the supported *downlink operating band* without any carrier transmitted.

For a multicarrier *single-band connector* or a *single-band connector* configured for intra-band contiguous or non-contiguous *carrier aggregation*, the definitions above apply to the lower edge of the carrier transmitted at the lowest carrier frequency and the upper edge of the carrier transmitted at the highest carrier frequency within a specified frequency band.

Inside any *sub-block gap* for a *single-band connector* operating in a *non-contiguous spectrum*, a combined *basic limit* shall be applied which is the cumulative sum of the *basic limits* specified for the adjacent *sub-blocks* on each side of the *sub-block gap*. The *basic limit* for each *sub-block* is specified in the clauses 4.3.2.2.2 to 4.3.2.2.4 below, where in this case:

- Δf is the separation between the *sub-block edge* frequency and the nominal -3 dB point of the measuring filter closest to the *sub-block edge*.
- f_{offset} is the separation between the *sub-block edge* frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\max}}$ is equal to the *sub-block gap* bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{\max} is equal to $f_{\text{offset}_{\max}}$ minus half of the bandwidth of the measuring filter.

For Wide Area BS, the requirements in clause 4.3.2.2.2 shall apply.

For Medium Range BS, the requirements in clause 4.3.2.2.3 shall apply.

For Local Area BS, the requirements of clause 4.3.2.2.4 shall apply.

For *BS Type 1-C*, the *operating band* unwanted emissions at each *antenna connector* shall not exceed the specified *basic limit*.

The *operating band* unwanted emissions requirements for *BS type 1-H* are that for each *TAB connector TX min cell group* and each applicable *basic limit* in clauses 4.3.2.2.2 to 4.3.2.2.4, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a limit specified as the *basic limit* + X, where $X = 10\log_{10}(N_{TXU, counted per cell})$.

In the following clauses the numerical values for f_{offset} , Δf , Δf_{OBUe} and Δf_{max} shall be expressed in MHz.

4.3.2.2.2 Wide Area BS

For a BS operating in Bands n1, n3, n8, n65 or *BS type 1-C* operating in bands n7 or n38, *basic limits* are specified in table 4.3.2.2.2-1.

Table 4.3.2.2.2-1: Wide Area BS operating band unwanted emission limits for bands n1, n3, n8, n65 or BS type 1-C in bands n7 or n38

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{offset} < 0,215 \text{ MHz}$	-12,5 dBm	30 kHz
$0,2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0,215 \text{ MHz} \leq f_{offset} < 1,015 \text{ MHz}$	$-12,5 - 15 \times (f_{offset} - 0,215) \text{ dBm}$	30 kHz
	$1,015 \text{ MHz} \leq f_{offset} < 1,5 \text{ MHz}$	-24,5 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f \leq \min(10 \text{ MHz}, \Delta f_{max})$	$1,5 \text{ MHz} \leq f_{offset} < \min(10,5 \text{ MHz}, f_{offset_{max}})$	-11,5 dBm	1 MHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{max}$	$10,5 \text{ MHz} \leq f_{offset} < f_{offset_{max}}$	-15 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -15 dBm/MHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{OBUe}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{max} < 10 \text{ MHz}$.			

For BS operating in Bands n20, n28, *basic limits* are specified in table 4.3.2.2.2-2.

Table 4.3.2.2.2-2: Wide Area BS operating band unwanted emission limits for bands n20, n28

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Basic limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f_offset < 5,05 MHz	$-5,5 - \frac{7}{5} \times (f_offset - 0,05) \text{ dBm}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_max)	5,05 MHz ≤ f_offset < min(10,05 MHz, f_offset_max)	-12,5 dBm	
10 MHz ≤ Δf ≤ Δf_max	10,05 MHz ≤ f_offset < f_offset_max	-16 dBm (note 3)	
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -16 dBm/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf_OBUE the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when Δf_max < 10 MHz.			

For BS operating in Bands n40, n41, n50, n75 or *BS Type I-H* operating in n7 or n38 *basic limits* are specified in table 4.3.2.2.2-3.

Table 4.3.2.2.2-3: Wide Area BS operating band unwanted emission limits for bands n40, n41, n50, n75 or BS Type I-H in bands 7 or 38

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-5,5 - \frac{7}{5} \times (f_{\text{offset}} - 0,05) \text{ dBm}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-12,5 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-15 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -15 dBm/MHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

For BS operating in Bands n77, n78, *basic limits* are specified in table 4.3.2.2.2-4.

Table 4.3.2.2.2-4: Wide Area BS operating band unwanted emission limits for bands n77, n78

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-5,2 - \frac{7}{5} \times (f_{\text{offset}} - 0,05) \text{ dBm}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-12,2 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-15 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -15 dBm/MHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

4.3.2.2.3 Medium Range BS

For the tables in this clause the following applies:

- for *BS type I-C*: $P_{\text{rated},x} = P_{\text{rated},c,AC}$
- for *BS type I-H*: $P_{\text{rated},x} = P_{\text{rated},c,\text{cell}} - 10 \times \log_{10}(N_{\text{TXU},\text{countedpercell}})$

For Medium Range BS in NR bands $\leq 3 \text{ GHz}$, the *basic limits* are specified in table 4.3.2.2.3-1 and table 4.3.2.2.3-2.

**Table 4.3.2.2.3-1: Medium Range BS operating band unwanted emission limits,
31 < P_{rated,x} ≤ 38 dBm (NR bands ≤ 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$P_{rated,x} - 51,5 \text{ dB} - \frac{7}{5} \times (f_{offset} - 0,05) \text{ dBm}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	P _{rated,x} - 58,5 dB	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	Min(P _{rated,x} - 60 dB, -25 dBm) (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be Min(P _{rated,x} - 60 dB, -25 dBm)/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

**Table 4.3.2.2.3-2: Medium Range BS operating band unwanted emission limits,
P_{rated,x} ≤ 31 dBm (NR bands ≤ 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$-20,5 - \frac{7}{5} \times (f_{offset} - 0,05) \text{ dBm}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	-27,5 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	-29 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -29 dBm/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

For Medium Range BS in NR bands > 3 GHz, the *basic limits* are specified in table 4.3.2.2.3-3 and table 4.3.2.2.3-4.

**Table 4.3.2.2.3-3: Medium Range BS operating band unwanted emission limits,
31 < P_{rated,x} ≤ 38 dBm (NR bands > 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$P_{rated,x} - 51,2 \text{ dB} - \frac{7}{5} \times (f_{offset} - 0,05) \text{ dBm}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	P _{rated,x} - 58,2 dB	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	Min(P _{rated,x} - 60 dB, -25 dBm) (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be Min(P _{rated,x} - 60 dB, -25 dBm)/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

**Table 4.3.2.2.3-4: Medium Range BS operating band unwanted emission limits,
 $P_{\text{rated},x} \leq 31$ dBm (NR bands > 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-20,2 \text{ dBm} - \frac{7}{5} \times (f_{\text{offset}} - 0,05) \text{ dBm}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-27,2 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-29 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is $\Delta f \geq 10$ MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -29 dBm/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10$ MHz.			

4.3.2.2.4 Local Area BS

For Local Area BS in NR bands ≤ 3 GHz, the *basic limits* are specified in table 4.3.2.2.4-1.

**Table 4.3.2.2.4-1: Local Area BS operating band unwanted emission limits
(NR bands ≤ 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Basic limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-28,5 - \frac{7}{5} \times (f_{\text{offset}} - 0,05) \text{ dBm}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offsetmax}})$	-35,5 dBm	
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offsetmax}}$	-37 dBm (note 3)	
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -37 dBm/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

For Local Area BS in NR bands > 3 GHz, the *basic limits* are specified in table 4.3.2.2.4-2.

**Table 4.3.2.2.4-2: Local Area BS operating band unwanted emission limits
(NR bands > 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Basic limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f_offset < 5,05 MHz	$-28,2 - \frac{7}{5} \times (f_{\text{offset}} - 0,05) \text{ dBm}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf_max)	5,05 MHz ≤ f_offset < min(10,05 MHz, f_offset_max)	-35,2 dBm	
10 MHz ≤ Δf ≤ Δf_max	10,05 MHz ≤ f_offset < f_offset_max	-37 dBm (note 3)	
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap. Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -37 dBm/100 kHz.			
NOTE 2: For a <i>multi-band connector</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf_OBUE the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf_max < 10 MHz.			

4.3.2.2.5 Additional limits

The limits in table 4.3.2.2.5-1 shall apply to BS operating in bands n77 and n78, for co-existence with FSS/FS. These limits are derived assuming a 21 dBi antenna gain.

The emissions for *BS type I-C*, for each *antenna connector* shall not exceed the *basic limits* in table 4.3.2.2.5-1.

Table 4.3.2.2.5-1: Additional operating band unwanted emission limits for bands n77 and n78

Frequency range	Basic limit	Measurement bandwidth
3 800 MHz to 3 805 MHz	0 dBm	5 MHz
3 805 MHz to 3 810 MHz	-6 dBm	5 MHz
3 810 MHz to 3 840 MHz	-8 dBm	5 MHz
Above 3 840 MHz	-23 dBm	5 MHz

For *BS Type I-H*, for each *TAB connector TX min cell group*, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed the *limit* in table 4.3.2.2.5-2.

Table 4.3.2.2.5-2: Additional operating band unwanted emission limits for bands n77 and n78

Frequency range	Limit	Measurement bandwidth
3 800 MHz to 3 805 MHz	16 dBm	5 MHz
3 805 MHz to 3 810 MHz	12 dBm	5 MHz
3 810 MHz to 3 840 MHz	1 dBm	5 MHz
Above 3 840 MHz	-14 dBm	5 MHz

NOTE 1: For a BS operating in band 20, additional limits for the protection of DTT are described in clause 6.6.4.5.6.2 in ETSI TS 138 141-1 [1]. This statement is provided for information and does not have any impact on the conformance requirements or essential radio test suites in the present document.

NOTE 2: For BS operating in bands 50, 51, 75 and 76 additional emission limits that might be applicable in the OBUE frequency domain are specified in clause 4.3.4.2.4.

4.3.2.3 Conformance

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

4.3.3 Adjacent Channel Leakage power Ratio (ACLR)

4.3.3.1 Definition and applicability

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.

The ACLR is defined with a square filter of bandwidth equal to the *transmission bandwidth* configuration of the transmitted signal (BW_{Config}) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables in clause 4.3.3.2.3.

The requirement applies during the *transmitter ON period*.

The requirements shall apply outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth* whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer's specification.

For a BS operating in a *non-contiguous spectrum*, the ACLR requirement in clause 4.3.3.2 shall apply in *sub-block gaps* for the frequency ranges defined in table 4.3.3.2.3-2, while the CACLR requirement in clause 4.3.3.2 shall apply in *sub-block gaps* for the frequency ranges defined in table 4.3.3.2.3-3.

For a *multi-band connector*, the ACLR requirement in clause 4.3.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 4.3.3.2.3-2, while the CACLR requirement in clause 4.3.3.2 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 4.3.3.2.3-3.

The Cumulative Adjacent Channel Leakage power Ratio (CACLR) in a *sub-block gap* or the *Inter RF Bandwidth gap* is the ratio of:

- a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the *sub-block gap* or the *Inter RF Bandwidth gap*; and
- b) the filtered mean power centred on a frequency channel adjacent to one of the respective *sub-block edges* or *Base Station RF Bandwidth edges*.

4.3.3.2 Limits

4.3.3.2.1 General

The absolute limits in clause 4.3.3.2.2 or the ACLR/CACLR relative limits in clause 4.3.3.2.3, whichever is less stringent, shall apply:

- for each antenna connector, in case of *BS Type I-C*;
- for each *TAB connector TX min cell group*, in case of *BS Type I-H*.

4.3.3.2.2 Absolute limits

For *BS Type I-C*, the filtered mean power centred on an adjacent channel frequency shall not exceed the absolute basic limit in table 4.3.3.2.2-1.

For *BS Type I-H*, the filtered mean power centred on an adjacent channel frequency shall not exceed a limit which is the absolute basic limit in table 4.3.3.2.2-1 + X, where $X = 10\log_{10}(N_{\text{TXU, counted per cell}})$.

Table 4.3.3.2.2-1: Base station ACLR/CACLR absolute *basic limit*

BS class	ACLR/CACLR absolute <i>basic limit</i>
Wide Area BS	-15 dBm/MHz
Medium Range BS	-25 dBm/MHz
Local Area BS	-32 dBm/MHz

4.3.3.2.3 Relative Limits

For operation in paired and unpaired spectrum, the ACLR shall not be less than the value specified in table 4.3.3.2.3-1.

Table 4.3.3.2.3-1: Base station ACLR limit

BS channel bandwidth of lowest/highest NR carrier transmitted BW_{Channel} (MHz)	BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted	Assumed adjacent channel carrier (informative)	Filter on the adjacent channel frequency and filter bandwidth	ACLR limit
5, 10, 15, 20	BW_{Channel}	NR of same BW (note 2)	Square (BW_{Config})	44,2 dB
	$2 \times BW_{\text{Channel}}$	NR of same BW (note 2)	Square (BW_{Config})	44,2 dB
	$BW_{\text{Channel}}/2 + 2,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	44,2 dB (note 3)
	$BW_{\text{Channel}}/2 + 7,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	44,2 dB (note 3)
25, 30, 40, 50, 60, 70, 80, 90, 100	BW_{Channel}	NR of same BW (note 2)	Square (BW_{Config})	43,8 dB
	$2 \times BW_{\text{Channel}}$	NR of same BW (note 2)	Square (BW_{Config})	43,8 dB
	$BW_{\text{Channel}}/2 + 2,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	43,8 dB (note 3)
	$BW_{\text{Channel}}/2 + 7,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	43,8 dB (note 3)
NOTE 1: BW_{Channel} and BW_{Config} are the BS channel bandwidth and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency.				
NOTE 2: With SCS that provides the largest transmission bandwidth configuration (BW_{Config}).				
NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA.				

For operation in *non-contiguous spectrum* or multiple bands, the ACLR shall not be less than the value specified in table 4.3.3.2.3-2.

Table 4.3.3.2.3-2: Base Station ACLR limit in non-contiguous spectrum or multiple bands

<i>BS channel bandwidth of lowest/highest NR carrier transmitted</i> BW_{Channel} (MHz)	Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)	BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and filter bandwidth	ACLR limit
5, 10, 15, 20	W _{gap} ≥ 15 (note 3)	2,5 MHz	5 MHz NR (note 2)	Square (BW _{Config})	44,2 dB
	W _{gap} ≥ 45 (note 4)				
	W _{gap} ≥ 20 (note 3) W _{gap} ≥ 50 (note 4)	7,5 MHz	5 MHz NR (note 2)		
25, 30, 40, 50, 60, 70, 80, 90, 100	W _{gap} ≥ 60 (note 4)	10 MHz	20 MHz NR (note 2)	Square (BW _{Config})	43,8 dB
	W _{gap} ≥ 30 (note 3)				
	W _{gap} ≥ 80 (note 4) W _{gap} ≥ 50 (note 3)	30 MHz	20 MHz NR (note 2)		
NOTE 1: BW _{Config} is the <i>transmission bandwidth</i> configuration of the assumed adjacent channel carrier.					
NOTE 2: With SCS that provides largest <i>transmission bandwidth</i> configuration (BW _{Config}).					
NOTE 3: Applicable in case the <i>BS channel bandwidth</i> of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.					
NOTE 4: Applicable in case the <i>BS channel bandwidth</i> of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz.					

For operation in a *non-contiguous spectrum* or multiple bands, the CACLR limits for NR carriers located on either side of the *sub-block gap* or the *Inter RF Bandwidth gap* are specified in table 4.3.3.2.3-3.

Table 4.3.3.2.3-3: Base station CACLR limit

<i>BS channel bandwidth of lowest/highest NR carrier transmitted</i> BW_{Channel} (MHz)	Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)	BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and filter bandwidth	CACLR limit
5, 10, 15, 20	$5 \leq W_{\text{gap}} < 15$ (note 3) $5 \leq W_{\text{gap}} < 45$ (note 4)	2,5 MHz	5 MHz NR (note 2)	Square (BW _{Config})	44,2 dB
	$10 < W_{\text{gap}} < 20$ (note 3) $10 \leq W_{\text{gap}} < 50$ (note 4)	7,5 MHz	5 MHz NR (note 2)		
25, 30, 40, 50, 60, 70, 80, 90, 100	$20 \leq W_{\text{gap}} < 60$ (Note 4) $20 \leq W_{\text{gap}} < 30$ (note 3)	10 MHz	20 MHz NR (note 2)	Square (BW _{Config})	43,8 dB
	$40 < W_{\text{gap}} < 80$ (note 4) $40 \leq W_{\text{gap}} < 50$ (note 3)	30 MHz	20 MHz NR (note 2)		
	NOTE 1: BW _{Config} is the <i>transmission bandwidth</i> configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest <i>transmission bandwidth</i> configuration (BW _{Config}). NOTE 3: Applicable in case the <i>BS channel bandwidth</i> of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz. NOTE 4: Applicable in case the <i>BS channel bandwidth</i> of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz.				

4.3.3.3 Conformance

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

4.3.4 Transmitter spurious emissions

4.3.4.1 Definition and applicability

The transmitter spurious emission limits shall apply from 9 kHz to 12,75 GHz or 5th harmonic limit of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in table 4.3.2.1-1.

NOTE: For *bands* n7, n38, n41, n77 and n78, the upper limit is more than 12,75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in Recommendation ITU-R SM.329-12 [i.4].

Additional limits in clause 4.3.4.2.4 may apply closer than Δf_{OBUE} from the edges of *downlink operating band*.

For a *multi-band connector*, each supported *operating band* together with Δf_{OBUE} around the band is excluded from the transmitter spurious emissions requirement.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

All limits are expressed as mean power (RMS).

The limits for protection of *BS receiver* shall be applied for NR FDD operation in order to prevent the receivers of the BSs being desensitized by emissions from a BS transmitter. Emissions are measured at the transmit *antenna connector* for *BS type 1-C* or at the *TAB connector* for *BS type 1-H* for any type of BS which has common or separate Tx/Rx *antenna connectors* / *TAB connectors*.

Additional spurious emissions limits shall be applied for the protection of system operating in frequency ranges other than the BS downlink *operating band*. The limits shall apply as protection of such systems that are deployed in the same geographical area as the BS. Some limits shall apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.) as listed in clauses 4.3.4.2.3 and 4.3.4.2.4.

4.3.4.2 Limits

4.3.4.2.1 General spurious emissions limits

The Tx spurious emissions for *BS type 1-C* for each *antenna connector* shall not exceed the *basic limits* specified in table 4.3.4.2.1-1.

For *BS type 1-H*, for each *TAB connector TX min cell group*, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed the *limit* specified in table 4.3.4.2.1-1.

Table 4.3.4.2.1-1: General BS transmitter spurious emission limits in FR1

Spurious frequency range	Limit	Measurement bandwidth	Notes
9 kHz to 150 kHz	-36 dBm	1 kHz	Notes 1 and 4
150 kHz to 30 MHz		10 kHz	Notes 1 and 4
30 MHz to 1 GHz		100 kHz	note 1
1 GHz to 12,75 GHz	-30 dBm	1 MHz	Notes 1 and 2
12,75 GHz - 5 th harmonic of the upper-frequency edge of the DL <i>operating band</i> in GHz		1 MHz	Notes 1, 2 and 3
NOTE 1: <i>Measurement bandwidths</i> as in Recommendation ITU-R SM.329-12 [i.4], s4.1.			
NOTE 2: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1.			
NOTE 3: This spurious frequency range applies only to <i>operating bands</i> for which the 5 th harmonic of the upper-frequency edge of the DL <i>operating band</i> is reaching beyond 12,75 GHz.			
NOTE 4: This spurious frequency range applies only to <i>BS type 1-C</i> and <i>BS type 1-H</i> .			

4.3.4.2.2 Limits for protection of the BS receiver

The Tx spurious emissions for *BS type 1-C* for each *antenna connector* shall not exceed the *basic limits* specified in table 4.3.4.2.2-1.

For *BS type 1-H*, for each *TAB connector TX min cell group*, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a limit specified as the *basic limit* + X, where $X = 10\log_{10}(N_{\text{TXU, counted per cell}})$.

Table 4.3.4.2.2-1: BS spurious emissions *basic limits* for protection of the BS receiver

BS class	Frequency range	Basic limit	Measurement bandwidth
Wide Area BS	F _{UL_low} to F _{UL_high}	-96 dBm	100 kHz
Medium Range BS		-91 dBm	
Local Area BS		-88 dBm	

4.3.4.2.3 Limits for co-existence with other systems

The power of any spurious emission shall not exceed the limits of table 4.3.4.2.3-1 for a BS where requirements for co-existence with the system listed in the first column apply. For a *multi-band connector*, the exclusions and conditions in the Exclusions and Conditions column of table 4.3.4.2.3-1 apply for each supported *operating band*.

The Tx spurious emissions for *BS type 1-C* for each *antenna connector* shall not exceed the *basic limits* specified in table 4.3.4.2.3-1.

For each *TAB connector TX min cell group*, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed a limit specified as the *basic limit* + X, where
 $X = 10\log_{10}(N_{TXU, \text{counted per cell}})$.

**Table 4.3.4.2.3-1: BS spurious emissions basic limits for BS
for co-existence with systems operating in other frequency bands**

Protected system	Frequency range for co-existence requirement	Basic limit	Measurement bandwidth	Exclusions and conditions
GSM900	921 MHz to 960 MHz	-57 dBm	100 kHz	This requirement shall not apply to BS operating in band n8.
	876 MHz to 915 MHz	-61 dBm	100 kHz	For the frequency range 880 MHz to 915 MHz, this requirement shall not apply to BS operating in band n8, since it is already covered by the requirement in clause 4.3.4.2.2.
DCS1800	1 805 MHz to 1 880 MHz	-47 dBm	100 kHz	This requirement shall not apply to BS operating in band n3.
	1 710 MHz to 1 785 MHz	-61 dBm	100 kHz	This requirement shall not apply to BS operating in band n3, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA FDD Band I or E-UTRA Band 1 or NR Band n1	2 110 MHz to 2 170 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n1 or n65.
	1 920 MHz to 1 980 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n1 or n65, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA FDD Band III or E-UTRA Band 3 or NR Band n3	1 805 MHz to 1 880 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n3.
	1 710 MHz to 1 785 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n3, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA FDD Band VII or E-UTRA Band 7 or NR Band n7	2 620 MHz to 2 690 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n7.
	2 500 MHz to 2 570 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n7, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8	925 MHz to 960 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n8.
	880 MHz to 915 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n8, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20	791 MHz to 821 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n20 or n28.
	832 MHz to 862 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n20, since it is already covered by the requirement in clause 4.3.4.2.2.
E-UTRA Band 28 or NR Band n28	758 MHz to 803 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in band n20 or n28.
	703 MHz to 748 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n28, since it is already covered by the requirement in clause 4.3.4.2.2.
UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38	2 570 MHz to 2 620 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n38.
UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40	2 300 MHz to 2 400 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n40.
E-UTRA Band 41 or NR Band n41	2 496 MHz to 2 690 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n41.
E-UTRA Band 50 or NR band n50	1 432 MHz to 1 517 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n74, n75 or n76.

Protected system	Frequency range for co-existence requirement	Basic limit	Measurement bandwidth	Exclusions and conditions
E-UTRA Band 51 or NR Band n51	1 427 MHz to 1 432 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n75 or n76.
E-UTRA Band 65 or NR Band n65	2 110 MHz to 2 200 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n1 or n65.
	1 920 MHz to 2 010 MHz	-49 dBm	1 MHz	For BS operating in Band n1, it shall apply for 1 980 MHz to 2 010 MHz, while the rest is covered in clause 4.3.4.2.2. This requirement shall not apply to BS operating in band n65, since it is already covered by the requirement in clause 4.3.4.2.2.
E-UTRA Band 75 or NR Band n75	1 432 MHz to 1 517 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n74, n75 or n76.
E-UTRA Band 76 or NR Band n76	1 427 MHz to 1 432 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n75 or n76.
NR Band n77	3 300 MHz to 4 200 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n77 and n78.
NR Band n78	3 300 MHz to 3 800 MHz	-52 dBm	1 MHz	This requirement shall not apply to BS operating in Band n77 and n78.
NR Band n80	1 710 MHz to 1 785 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n3, since it is already covered by the requirement in clause 4.3.4.2.2.
NR Band n81	880 MHz to 915 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n8, since it is already covered by the requirement in clause 4.3.4.2.2.
NR Band n82	832 MHz to 862 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n20, since it is already covered by the requirement in clause 4.3.4.2.2.
NR Band n83	703 MHz to 748 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n28, since it is already covered by the requirement in clause 4.3.4.2.2.
NR Band n84	1 920 MHz to 1 980 MHz	-49 dBm	1 MHz	This requirement shall not apply to BS operating in band n1, since it is already covered by the requirement in clause 4.3.4.2.2.

4.3.4.2.4 Additional limits

The following limits shall apply to BS operating in Band n50 and n75 within 1 432 MHz to 1 452 MHz, and in Band n51 and Band n76. The limits are specified in table 4.3.4.2.4-1. These limits shall apply also at the frequency range from Δf_{OBUE} below the lowest frequency of the BS downlink *operating band* up to Δf_{OBUE} above the highest frequency of the BS downlink *operating band*.

The emissions for *BS type I-C* for each *antenna connector* shall not exceed the *basic limits* specified in table 4.3.4.2.4-1.

For each *TAB connector TX min cell group*, the power summation of the emissions at the *TAB connectors* of the *TAB connector TX min cell group* shall not exceed the *limit* in table 4.3.4.2.4-1.

Table 4.3.4.2.4-1: Additional emission limit for BS operating in Band n50 and n75 within 1 432 MHz to 1 452 MHz, and in band n51 and n76

Filter centre frequency, filter	Limit	Measurement bandwidth
$F_{\text{filter}} = 1\,413,5\text{ MHz}$	-42 dBm	27 MHz

NOTE: For a BS operating in NR bands n50 and n75 additional limits are described in table 6.6.5.5.1.3-5 in ETSI TS 138 141-1 [1]. This statement is provided for information and does not have any impact on the conformance requirements or essential radio test suites in the present document.

4.3.4.3 Conformance

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

4.3.5 Base Station output power

4.3.5.1 Definition and applicability

This is an output power accuracy requirement defined at the *TAB connector* during the *transmitter ON period*.

The conducted BS output power requirements are specified at *single-band connector* or at *multi-band connector*.

NOTE: The BS class specific *rated carrier output power* limits for BS type 1-C and BS type 1-H can be found in ETSI TS 138 141-1 [1], clause 6.2.1.

4.3.5.2 Limits

For each *single-band connector* or *multi-band connector*, the output power level shall remain within the values provided in table 4.3.5.2-1 for normal and extreme test environments, relative to $P_{\text{rated,c,AC}}$ for BS type 1-C or relative to $P_{\text{rated,c,TABC}}$ for BS type 1-H (D.21).

Table 4.3.5.2-1: Requirements for conducted BS output power

BS type	Frequency	Normal test environment	Extreme test environment
1-C and 1-H	$f \leq 3,0$ GHz	$\pm 2,7$ dB	$\pm 3,2$ dB
	$3,0$ GHz $< f \leq 4,2,0$ GHz	$\pm 3,0$ dB	$\pm 3,5$ dB

4.3.5.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.5 of the present document.

4.3.6 Transmit intermodulation

4.3.6.1 Definition and applicability

The transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter unit via the antenna, RDN and antenna array. The requirement shall apply during the *transmitter ON period* and the *transmitter transient period*.

For BS type 1-C, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *antenna connector*.

For BS type 1-H, the transmitter intermodulation level is the power of the intermodulation products when an interfering signal is injected into the *TAB connector*.

For BS type 1-H, there are two types of transmitter intermodulation cases captured by the transmitter intermodulation requirement in clause 6.7 in ETSI TS 138 141-1 [1]:

- 1) Co-location transmitter intermodulation in which the interfering signal is from a co-located base station.
- 2) Intra-system transmitter intermodulation in which the interfering signal is from other transmitter units within the BS type 1-H.

4.3.6.2 Limits

4.3.6.2.1 BS type 1-C: Co-location limits

For *BS type 1-C*, the wanted signal and interfering signal centre frequency is specified in table 4.3.6.2.1-1, where interfering signal level is *rated total output power* ($P_{\text{rated,t,AC}}$) at *antenna connector* in the *operating band* -30 dB.

The requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For a BS operating in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block edges*.

For a *multi-band connector*, the requirement shall apply relative to the *Base Station RF Bandwidth edges* of each supported *operating band*. In case the *Inter RF Bandwidth gap* is less than $3 \times BW_{\text{Channel}}$ MHz (where BW_{Channel} is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the *Inter RF Bandwidth gap*.

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 4.3.2.2 (OBUE), 4.3.3.2 (ACLR) and 4.3.4.2 (Tx spurious) in the presence of an NR interfering signal according to table 4.3.6.2.1-1.

Table 4.3.6.2.1-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

Parameter	Description
Wanted signal type	NR single carrier, or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers
Interfering signal type	NR signal, the minimum <i>BS channel bandwidth</i> (BW_{Channel}) with 15 kHz SCS of the band defined in clause 5.3.5 in ETSI TS 138 104 [3]
Interfering signal power level	<i>Rated total output power</i> ($P_{\text{rated,t,AC}}$) in the <i>operating band</i> - 30 dB
Interfering signal centre frequency offset from the lower/upper edge of the wanted signal or edge of <i>sub-block</i> inside a <i>sub-block gap</i>	$f_{\text{offset}} = \pm BW_{\text{Channel}} \left(n - \frac{1}{2} \right)$, for $n=1, 2$ and 3
NOTE: Interfering signal positions that are partially or completely outside of any downlink <i>operating band</i> of the BS are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink <i>operating bands</i> listed in table 1-2.	

4.3.6.2.2 BS type 1-H: Co-location limits

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 4.3.2.2, 4.3.3.2 and 4.3.4.2 in the presence of an NR interfering signal according to table 4.3.6.2.2-1.

The requirement is applicable outside the *Base Station RF Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For *TAB connectors* supporting operation in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block edges*.

For *multi-band connector*, the requirement shall apply relative to the *Base Station RF Bandwidth edges* of each *operating band*. In case the *inter RF Bandwidth gap* is less than $3 \times BW_{\text{Channel}}$ MHz (where BW_{Channel} is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the *inter RF Bandwidth gap*.

Table 4.3.6.2.2-1: Interfering and wanted signals for the co-location transmitter intermodulation requirement

Parameter	Description
Wanted signal type	NR single carrier, or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers
Interfering signal type	NR signal, the minimum <i>BS channel bandwidth</i> (BW_{Channel}) with 15 kHz SCS of the band defined in clause 5.3.5 in ETSI TS 138 104 [3]
Interfering signal power level	<i>Rated total output power per TAB connector</i> ($P_{\text{rated,t,TABC}}$) in the <i>operating band</i> -30 dB
Interfering signal centre frequency offset from the lower/upper edge of the wanted signal or edge of <i>sub-block</i> inside a gap	$f_{\text{offset}} = \pm BW_{\text{Channel}} \left(n - \frac{1}{2} \right)$, for $n=1, 2$ and 3
NOTE: Interfering signal positions that are partially or completely outside of any downlink <i>operating band</i> of the <i>TAB connector</i> are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink <i>operating bands</i> listed in table 1-2.	

4.3.6.2.3 *BS type 1-H*: Intra-system requirement

The transmitter intermodulation level shall not exceed the unwanted emission limits in clauses 4.3.2.2 (OBUE) and 4.3.3.2 (ACLR) in the presence of a co-channel NR interfering signal the same as the wanted signal. The interfering signal shall be incoherent with the wanted signal.

The interfering signal power level at each *TAB connector* is determined as the sum of the co-channel leakage power coupled via the combined RDN and Antenna Array from all the other *TAB connectors*, but does not comprise power radiated from the Antenna Array and reflected back from the environment. The power at each of the interfering *TAB connectors* is $P_{\text{rated,c,TABC}}$.

4.3.6.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.6 of the present document.

4.3.7 Receiver spurious emissions

4.3.7.1 Definition and applicability

The receiver spurious emissions power is the power of emissions generated or amplified in a receiver unit that appear at the *antenna connector* (for *BS type 1-C*) or at the *TAB connector* (for *BS type 1-H*).

The receiver spurious emission limits shall apply from 30 MHz to 12,75 GHz or the 5th harmonic of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in clause 4.3.13.1.

NOTE 1: For *bands* n7, n38, n41, n77 and n78, the upper limit of the spurious range is more than 12,75 GHz in order to comply with the 5th harmonic limit of the uplink *operating band*, as specified in Recommendation ITU-R SM.329-12 [i.4].

The requirements apply to all BS with separate RX and TX *antenna connectors* / *TAB connectors*.

NOTE 2: In this case for FDD operation the test is performed when both TX and RX are on, with the TX *antenna connectors* / *TAB connectors* terminated.

For *antenna connectors* / *TAB connectors* supporting both RX and TX in TDD, the limits shall apply during the transmitter *OFF* period.

For *antenna connectors* / *TAB connectors* supporting both RX and TX in FDD, the RX spurious emissions requirements are superseded by the TX spurious emissions limits, as specified in clause 4.3.4.

For RX-only *multi-band connectors*, the spurious emissions requirements are subject to exclusion zones in each supported *operating band*. For *multi-band connectors* that both transmit and receive in *operating band* supporting TDD, RX spurious emissions requirements are applicable during the *transmitter OFF period* and are subject to exclusion zones in each supported *operating band*.

For *BS type I-H*, every *TAB connector* supporting reception in an *operating band* shall map to one *TAB connector RX min cell group* (D.33), where mapping of *TAB connectors* to cells/beams is implementation dependent.

4.3.7.2 Limits

For *BS type I-C*, for each *antenna connector*, the power of emissions shall not exceed the *limits* specified in table 4.3.7.2-1.

For *BS type I-H*, for each *TAB connector RX min cell group* the power summation of the emissions at respective *TAB connectors* shall not exceed *limits* specified in table 4.3.7.2-1.

In addition to the limits in table 4.3.7.2-1, the power of any spurious emission shall not exceed the limits specified in clauses 4.3.4.2.2, 4.3.4.2.3 and 4.3.4.2.4.

Table 4.3.7.2-1: General BS receiver spurious emissions limits

Spurious frequency range	Limit	Measurement bandwidth	Notes
30 MHz to 1 GHz	-57 dBm	100 kHz	Note 1
1 GHz to 12,75 GHz	-47 dBm	1 MHz	Notes 1 and 2
12,75 GHz - 5 th harmonic of the upper frequency edge of the UL <i>operating band</i> in GHz	-47 dBm	1 MHz	Notes 1, 2 and 3
NOTE 1: <i>Measurement bandwidths</i> as in Recommendation ITU-R SM.329-12 [i.4], s4.1.			
NOTE 2: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1.			
NOTE 3: This spurious frequency range applies only for <i>operating bands</i> for which the 5 th harmonic of the upper frequency edge of the UL <i>operating band</i> is reaching beyond 12,75 GHz.			
NOTE 4: The frequency range from Δf_{OBUe} below the lowest frequency of the BS transmitter <i>operating band</i> to Δf_{OBUe} above the highest frequency of the BS transmitter <i>operating band</i> , may be excluded from the requirement. Δf_{OBUe} is defined in clause 4.3.2.1. For <i>multi-band connectors</i> , the exclusion applies to all supported <i>operating bands</i> .			

4.3.7.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.7 of the present document.

4.3.8 In-band blocking

4.3.8.1 Definition and applicability

The in-band blocking characteristics is a measure of the receiver's ability to receive a wanted signal at its assigned channel at the *antenna connector* for *BS type I-C* or *TAB connector* for *BS type I-H* in the presence of an unwanted interferer, which is an NR signal for general blocking or an NR signal with one resource block for narrowband blocking.

4.3.8.2 Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type I-C antenna connector* or *BS type I-H TAB connector* using the parameters in tables 4.3.8.2-1, 4.3.8.2-2 and 4.3.8.2-3 for general blocking and narrowband blocking requirements. The reference measurement channel for the wanted signal is identified in clause 4.3.12 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal are further specified in annex E of ETSI TS 138 141-1 [1].

The in-band blocking requirements apply outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For *BS type 1-C* and *BS type 1-H*, the in-band blocking requirement applies from $F_{UL_low} - \Delta f_{OOB}$ to $F_{UL_high} + \Delta f_{OOB}$, excluding the downlink frequency range of the *operating band*. The Δf_{OOB} for *BS type 1-C* and *BS type 1-H* is defined in table 4.3.8.2-1.

Minimum conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*.

Table 4.3.8.2-1: Δf_{OOB} offset for NR operating bands

BS type	Operating band characteristics	Δf_{OOB} (MHz)
BS type 1-C	$F_{UL_high} - F_{UL_low} \leq 200$ MHz	20
	$200 \text{ MHz} < F_{UL_high} - F_{UL_low} \leq 900$ MHz	60
BS type 1-H	$F_{UL_high} - F_{UL_low} < 100$ MHz	20
	$100 \text{ MHz} \leq F_{UL_high} - F_{UL_low} \leq 900$ MHz	60

For a BS operating in a *non-contiguous spectrum* within any *operating band*, the in-band blocking requirements apply also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as twice the interfering signal minimum offset in table 4.3.8.2-2. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For a *multi-band connector*, the blocking requirements apply in the in-band blocking frequency ranges for each supported *operating band*. The requirement applies also inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as twice the interfering signal minimum offset in table 4.3.8.2-2.

For a BS operating in a *non-contiguous spectrum* within any *operating band*, the narrowband blocking requirement applies also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the bandwidth of the NR interfering signal in table 4.3.8.2-4. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For a *multi-band connector*, the narrowband blocking requirement applies also inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the NR interfering signal in table 4.3.8.2-4. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 4.3.8.2-2: Base station general blocking requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm)	Interfering signal mean power (dBm)	Interfering signal centre frequency minimum offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
5, 10, 15, 20	$P_{\text{REFSENS}} + 6$ dB (note 2)	Wide Area BS: -43 Medium Range BS: -38 Local Area BS: -35	$\pm 7,5$	5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs
25, 30, 40, 50, 60, 70, 80, 90, 100	$P_{\text{REFSENS}} + 6$ dB (note 2)	Wide Area BS: -43 Medium Range BS: -38 Local Area BS: -35	± 30	20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 100 RBs
NOTE 1: P_{REFSENS} depends on the BS channel bandwidth as specified in clause 4.3.12.2.				
NOTE 2: For a <i>multi-band connector</i> , in case of interfering signal that is not in the in-band blocking frequency range of the <i>operating band</i> where the wanted signal is present, or in an adjacent or overlapping band, the wanted signal mean power is equal to $P_{\text{REFSENS}} + 1,4$ dB.				

Table 4.3.8.2-3: Base station narrowband blocking requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm)	Interfering signal mean power (dBm)
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 (note 1)	$P_{\text{REFSENS}} + 6 \text{ dB}$	Wide Area BS: -49 Medium Range BS: -44 Local Area BS: -41
NOTE 1: The SCS for the <i>lowest/highest carrier</i> received is the lowest SCS supported by the BS for that <i>BS channel bandwidth</i> .		
NOTE 2: P_{REFSENS} depends on the <i>BS channel bandwidth</i> as specified in clause 4.3.12.2.		
NOTE 3: 7,5 kHz shift is not applied to the wanted signal.		

Table 4.3.8.2-4: Base station narrowband blocking interferer frequency offsets

<i>BS channel bandwidth of the lowest/highest carrier received (MHz)</i>	<i>Interfering RB centre frequency offset to the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 2)</i>	<i>Type of interfering signal</i>
5	$\pm(350 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24	5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB
10	$\pm(355 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24	
15	$\pm(360 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24	
20	$\pm(350 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24	
25	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB
30	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
40	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
50	$\pm(560 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
60	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
70	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
80	$\pm(560 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
90	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
100	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 100	
NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the <i>channel bandwidth</i> of the interfering signal is located adjacently to the lower/upper <i>Base Station RF Bandwidth edge</i> or <i>sub-block edge</i> inside a <i>sub-block gap</i> .		
NOTE 2: The centre of the interfering RB refers to the frequency location between the two central subcarriers.		

4.3.8.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.8 of the present document.

4.3.9 Out-of-band blocking

4.3.9.1 Definition and applicability

The out-of-band blocking characteristics is a measure of the receiver ability to receive a wanted signal at its assigned channel at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of an unwanted interferer out of the *operating band*, which is a CW signal for out-of-band blocking.

4.3.9.2 Limits

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channel, with a wanted and an interfering signal coupled to *BS type 1-C antenna connector* or *BS type 1-H TAB connector* using the parameters in table 4.3.9.2-1. The reference measurement channel for the wanted signal is identified in clause 4.3.12 for each channel bandwidth and *BS class*.

For *BS type 1-C* and *BS type 1-H*, the out-of-band blocking requirement applies from 1 MHz to $F_{UL_low} - \Delta f_{OOB}$ and from $F_{UL_high} + \Delta f_{OOB}$ up to 12 750 MHz, including the downlink frequency range of the FDD *operating band* for BS supporting FDD. The Δf_{OOB} for *BS type 1-C* and *BS type 1-H* is defined in table 4.3.8.2-1.

Minimum conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*.

For a BS capable of multi-band operation, the requirement in the out-of-band blocking frequency ranges applies for each *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to clause 4.3.8.2 shall be excluded from the out-of-band blocking requirement.

Table 4.3.9.2-1: Out-of-band blocking requirement

Wanted signal mean power (dBm)	Interfering signal mean power (dBm)	Type of interfering signal
$P_{REFSENS} + 6$ dB (note)	-15	CW carrier
NOTE: $P_{REFSENS}$ depends on the <i>BS channel bandwidth</i> as specified in clause 4.3.12.2.		

4.3.9.3 Conformance

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

4.3.10 Receiver intermodulation

4.3.10.1 Definition and applicability

Third and higher-order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of two interfering signals which have a specific frequency relationship to the wanted signal.

4.3.10.2 Limits

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals coupled to the *BS type 1-C antenna connector* or *BS type 1-H TAB connector*, with the conditions specified in tables 4.3.10.2-1 and 4.3.10.2-2 for intermodulation and in tables 4.3.10.2-3 and 4.3.10.2-4 for narrowband intermodulation. The reference measurement channel for the wanted signal is identified in clause 4.3.12 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal is further specified in annex E in ETSI TS 138 141-1 [1].

The subcarrier spacing for the modulated interfering signal shall, in general, be the same as the subcarrier spacing for the wanted signal, except for the case of wanted signal subcarrier spacing 60 kHz and *BS channel bandwidth* less than 20 MHz, for which the subcarrier spacing of the interfering signal should be 30 kHz.

The receiver intermodulation requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth* edges. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *R Maximum Radio Bandwidth edges*.

For a BS operating in a *non-contiguous spectrum* within any *operating band*, the narrowband intermodulation requirement applies also inside any *sub-block gap* in case the *sub-block gap* is at least as wide as the bandwidth of the NR interfering signal. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For a BS capable of multi-band operation or *multi-band TAB connectors*, the intermodulation requirement applies also inside any *Inter RF Bandwidth gap*, in case the gap size is at least twice as wide as the NR interfering signal centre frequency offset from the *Base Station RF Bandwidth edge*.

For a BS capable of multi-band operation or *multi-band TAB connectors*, the narrowband intermodulation requirement applies also inside any *Inter RF Bandwidth gap* in case the gap size is at least as wide as the NR interfering signal. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 4.3.10.2-1: General intermodulation requirement

BS class	Wanted Signal mean power (dBm)	Mean power of interfering signals (dBm)	Type of interfering signals
Wide Area BS	P _{REFSENS} + 6 dB	-52	See table 4.3.10.2-2
Medium Range BS	P _{REFSENS} + 6 dB	-47	
Local Area BS	P _{REFSENS} + 6 dB	-44	
NOTE: P _{REFSENS} depends on the <i>BS class</i> and on the <i>BS channel bandwidth</i> as specified in clause 4.3.12.2.			

Table 4.3.10.2-2: Interfering signals for intermodulation requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signals centre frequency offset from the lower/upper Base Station RF Bandwidth edge (MHz)	Type of interfering signals (note 3)
5	±7,5	CW
	±17,5	5 MHz DFT-s-OFDM NR signal, (note 1)
10	±7,465	CW
	±17,5	5 MHz DFT-s-OFDM NR signal, (note 1)
15	±7,43	CW
	±17,5	5 MHz DFT-s-OFDM NR signal, (note 1)
20	±7,395	CW
	±17,5	5 MHz DFT-s-OFDM NR signal, (note 1)
25	±7,465	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
30	±7,43	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
40	±7,45	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
50	±7,35	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
60	±7,49	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
70	±7,42	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
80	±7,44	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
90	±7,46	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)
100	±7,48	CW
	±25	20 MHz DFT-s-OFDM NR signal, (note 2)

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signals centre frequency offset from the lower/upper Base Station RF Bandwidth edge (MHz)	Type of interfering signals (note 3)
NOTE 1: For the 15 kHz subcarrier spacing, the number of RB is 25. For the 30 kHz subcarrier spacing, the number of RB is 10.		
NOTE 2: For the 15 kHz subcarrier spacing, the number of RB is 100. For the 30 kHz subcarrier spacing, the number of RB is 50. For the 60 kHz subcarrier spacing, the number of RB is 24.		
NOTE 3: The RBs shall be placed adjacent to the <i>transmission bandwidth</i> configuration edge which is closer to the <i>Base Station RF Bandwidth</i> edge.		

Table 4.3.10.2-3: Narrowband intermodulation requirement in FR1

BS type	Wanted signal mean power (dBm) (note)	Interfering signal mean power (dBm)	Type of interfering signals
Wide Area BS	P _{REFSENS} + 6 dB	-52	See table 4.3.10.2-4
Medium Range BS	P _{REFSENS} + 6 dB	-47	
Local Area BS	P _{REFSENS} + 6 dB	-44	
NOTE: P _{REFSENS} depends on the <i>BS channel bandwidth</i> as specified in clause 4.3.12.2.			

Table 4.3.10.2-4: Interfering signals for narrowband intermodulation requirement in FR1

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 3)	Type of interfering signals
5	± 360	CW
	$\pm 1\,420$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
10	± 370	CW
	$\pm 1\,960$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
15 (note 2)	± 380	CW
	$\pm 1\,960$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
20 (note 2)	± 390	CW
	$\pm 2\,320$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
25 (note 2)	± 325	CW
	$\pm 2\,350$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
30 (note 2)	± 335	CW
	$\pm 2\,350$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
40 (note 2)	± 355	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
50 (note 2)	± 375	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
60 (note 2)	± 395	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
70 (note 2)	± 415	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
80 (note 2)	± 435	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
90 (note 2)	± 365	CW
	$\pm 2\,530$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 3)	Type of interfering signals
100 (note 2)	± 385	CW
	$\pm 2\,530$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the <i>BS channel bandwidth</i> of the interfering signal is located adjacently to the lower/upper <i>Base Station RF Bandwidth edge</i> or <i>sub-block edge</i> inside a <i>sub-block gap</i> .		
NOTE 2: This requirement shall apply only for a G-FRx reference measurement channel mapped to the frequency range at the <i>channel edge</i> adjacent to the interfering signals.		
NOTE 3: The centre of the interfering RB refers to the frequency location between the two central subcarriers.		

4.3.10.3 Conformance

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

4.3.11 Adjacent Channel Selectivity (ACS)

4.3.11.1 Definition and applicability

Adjacent Channel Selectivity (ACS) is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency at the *antenna connector* for *BS type 1-C* or *TAB connector* for *BS type 1-H* in the presence of an adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system.

4.3.11.2 Limits

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channel.

For BS, the wanted and the interfering signals coupled to the *BS type 1-C antenna connector* or *BS type 1-H TAB connector* are specified in table 4.3.11.2-1 and the frequency offset between the wanted and interfering signal in table 4.3.11.2-2 for ACS. The reference measurement channel for the wanted signal is identified in clause 4.3.12 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal are further specified in annex E in ETSI TS 138 141-1 [1].

The ACS requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The interfering signal offset is defined relative to the *Base station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For a BS operating in a *non-contiguous spectrum* within any *operating band*, the ACS requirement shall apply also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the NR interfering signal in table 4.3.11.2-2. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For a *multi-band connector*, the ACS requirement shall apply also inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the NR interfering signal in table 4.3.11.2-2. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Conducted requirement is defined at the *antenna connector* for *BS type 1-C* and at the *TAB connector* for *BS type 1-H*.

Table 4.3.11.2-1: Base station ACS requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm)	Interfering signal mean power (dBm)
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 (note 1)	$P_{\text{REFSENS}} + 6\text{ dB}$	Wide Area BS: -52 Medium Range BS: -47 Local Area BS: -44
NOTE 1: The SCS for the <i>lowest/highest carrier</i> received is the lowest SCS supported by the BS for that bandwidth.		
NOTE 2: P_{REFSENS} depends on the <i>BS channel bandwidth</i> as specified in clause 4.3.12.2.		

Table 4.3.11.2-2: Base Station ACS interferer frequency offset values

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
5	$\pm 2,5025$	5 MHz DFT-s-OFDM NR signal 15 kHz SCS, 25 RBs
10	$\pm 2,5075$	
15	$\pm 2,5125$	
20	$\pm 2,5025$	
25	$\pm 9,4675$	
30	$\pm 9,4725$	20 MHz DFT-s-OFDM NR signal 15 kHz SCS, 100 RBs
40	$\pm 9,4675$	
50	$\pm 9,4625$	
60	$\pm 9,4725$	
70	$\pm 9,4675$	
80	$\pm 9,4625$	
90	$\pm 9,4725$	
100	$\pm 9,4675$	

4.3.11.3 Conformance

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

4.3.12 Reference sensitivity level

4.3.12.1 Definition and applicability

The reference sensitivity power level P_{REFSENS} is the minimum mean power received at the *antenna connector* for BS type 1-C or TAB connector for BS type 1-H at which a throughput requirement shall be met for a specified reference measurement channel.

4.3.12.2 Limits

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channel with parameters specified in table 4.3.12.2-1 for Wide Area BS, in table 4.3.12.2-2 for Medium Range BS and in table 4.3.12.2-3 for Local Area BS.

Reference measurement channels are specified in ETSI 138 141-1 [1], clause A-1.

Table 4.3.12.2-1: NR Wide Area BS reference sensitivity levels

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	Reference sensitivity power level, P_{REFSENS} (dBm)		
			$f \leq 3,0 \text{ GHz}$	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$4,2 \text{ GHz} < f \leq 6,0 \text{ GHz}$
5, 10, 15	15	G-FR1-A1-1	-101	-100,7	-100,5
10, 15	30	G-FR1-A1-2	-101,1	-100,8	-100,6
10, 15	60	G-FR1-A1-3	-98,2	-97,9	-97,7
20, 25, 30, 40, 50	15	G-FR1-A1-4	-94,6	-94,3	-94,1
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-94,9	-94,6	-94,4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-95	-94,7	-94,5

NOTE: P_{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.

Table 4.3.12.2-2: NR Medium Range BS reference sensitivity levels

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	Reference sensitivity power level, P_{REFSENS} (dBm)		
			$f \leq 3,0 \text{ GHz}$	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$4,2 \text{ GHz} < f \leq 6,0 \text{ GHz}$
5, 10, 15	15	G-FR1-A1-1	-96	-95,7	-95,5
10, 15	30	G-FR1-A1-2	-96,1	-95,8	-95,6
10, 15	60	G-FR1-A1-3	-93,2	-92,9	-92,7
20, 25, 30, 40, 50	15	G-FR1-A1-4	-89,6	-89,3	-89,1
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-89,9	-89,6	-89,4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-90	-89,7	-89,5
NOTE: P_{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.					

Table 4.3.12.2-3: NR Local Area BS reference sensitivity levels

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	Reference sensitivity power level, P_{REFSENS} (dBm)		
			$f \leq 3,0 \text{ GHz}$	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$4,2 \text{ GHz} < f \leq 6,0 \text{ GHz}$
5, 10, 15	15	G-FR1-A1-1	-93	-92,7	-92,5
10, 15	30	G-FR1-A1-2	-93,1	-92,8	-92,6
10, 15	60	G-FR1-A1-3	-90,2	-89,9	-89,7
20, 25, 30, 40, 50	15	G-FR1-A1-4	-86,6	-86,3	-86,1
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-86,9	-86,6	-86,4
20, 25, 30, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-87	-86,7	-86,5
NOTE: P_{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.					

4.3.12.3 Conformance

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

4.3.13 OTA operating band unwanted emissions

4.3.13.1 Definition and applicability

The OTA limits for *operating band* unwanted emissions are specified as TRP per RIB.

For BS type 1-O, for a RIB operating in multi-carrier or contiguous CA, the requirements apply to BS channel bandwidths of the outermost carrier. In addition, for a RIB operating in *non-contiguous spectrum*, the requirements shall apply inside any *sub-block gap*. In addition, for a *multi-band RIB*, the requirements shall apply inside any *Inter RF Bandwidth gap*.

For BS type 2-O, for a RIB operating in multi-carrier or contiguous CA, the requirements apply to the frequencies starting from the edge of the *contiguous transmission bandwidth*. In addition, for a RIB operating in *non-contiguous spectrum*, the requirements apply inside any *sub-block gap*.

The maximum offset of the *operating band* unwanted emissions mask from the *operating band* edge is Δf_{OBUE} . The value of Δf_{OBUE} is defined in table 4.3.13.1-1 for *BS type 1-O* and *BS type 2-O* for the NR *operating bands*.

Table 4.3.13.1-1: Maximum offset Δf_{OBUE} outside the downlink operating band

BS type	Operating band characteristics	Δf_{OBUE} (MHz)
BS type 1-O	$F_{\text{DL_high}} - F_{\text{DL_low}} < 100 \text{ MHz}$	10
	$100 \text{ MHz} \leq F_{\text{DL_high}} - F_{\text{DL_low}} \leq 900 \text{ MHz}$	40
BS type 2-O	$F_{\text{DL_high}} - F_{\text{DL_low}} \leq 3\,250 \text{ MHz}$	1 500

4.3.13.2 Limits for BS type 1-O

4.3.13.2.1 General

The emission levels shall not exceed the limits specified in clauses 4.3.13.2.2 to 4.3.13.2.4 to, where:

- Δf is the separation between the *channel edge* frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.
- f_{offset} is the separation between the *channel edge* frequency and the centre of the measuring filter.
- $f_{\text{offset_max}}$ is the offset to the frequency Δf_{OBUE} MHz outside the *downlink operating band*.
- Δf_{max} is equal to $f_{\text{offset_max}}$ minus half of the bandwidth of the measuring filter.

For a *multi-band RIB* inside any *Inter RF Bandwidth gaps* with $W_{\text{gap}} < 2 \times \Delta f_{\text{OBUE}}$, emissions shall not exceed the cumulative sum of the limits specified at the *Base Station RF Bandwidth edges* on each side of the *Inter RF Bandwidth gap*. The limits for *Base Station RF Bandwidth edge* is specified in clauses 4.3.13.2.2 to 4.3.13.2.4, where in this case:

- Δf is the separation between the *Base Station RF Bandwidth edge* frequency and the nominal -3 dB point of the measuring filter closest to the *Base Station RF Bandwidth edge*.
- f_{offset} is the separation between the *Base Station RF Bandwidth edge* frequency and the centre of the measuring filter.
- $f_{\text{offset_max}}$ is equal to the *Inter RF Bandwidth gap* minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to $f_{\text{offset_max}}$ minus half of the bandwidth of the measuring filter.

For a *multi-band RIB*, the *operating band* unwanted emission limits apply also in a supported *operating band* without any carrier transmitted, in the case where there are carrier(s) transmitted in another supported *operating band*. In this case, no cumulative limit is applied in the *inter-band gap* between a supported *downlink operating band* with carrier(s) transmitted and a supported *downlink operating band* without any carrier transmitted and:

- In case the *inter-band gap* between a supported *downlink operating band* with carrier(s) transmitted and a supported *downlink operating band* without any carrier transmitted is less than $2 \times \Delta f_{\text{OBUE}}$, $f_{\text{offset_max}}$ shall be the offset to the frequency Δf_{OBUE} MHz outside the outermost edges of the two supported *downlink operating bands* and the *operating band* unwanted emission limit of the band where there are carriers transmitted, as defined in the tables of the present clause, shall apply across both downlink bands.
- In other cases, the *operating band* unwanted emission limit of the band where there are carriers transmitted, as defined in the tables of the present clause for the largest frequency offset (Δf_{max}), shall apply from Δf_{OBUE} MHz below the lowest frequency, up to Δf_{OBUE} MHz above the highest frequency of the supported *downlink operating band* without any carrier transmitted.

For a multicarrier *single-band RIB* or a *single-band RIB* configured for intra-band contiguous or non-contiguous *carrier aggregation*, the definitions above apply to the lower edge of the carrier transmitted at the lowest carrier frequency and the upper edge of the carrier transmitted at the highest carrier frequency within a specified frequency band.

In addition, inside any *sub-block* gap for a *single-band RIB* operating in a *non-contiguous spectrum*, emissions shall not exceed the cumulative sum of the limits specified for the adjacent *sub-blocks* on each side of the *sub-block* gap. The limits for each *sub-block* are specified in clauses 4.3.13.2.2 to 4.3.13.2.4, where in this case:

- Δf is the separation between the *sub-block* edge frequency and the nominal -3 dB point of the measuring filter closest to the *sub-block* edge.
- f_{offset} is the separation between the *sub-block* edge frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\text{max}}}$ is equal to the *sub-block* gap bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to $f_{\text{offset}_{\text{max}}}$ minus half of the bandwidth of the measuring filter.

4.3.13.2.2 Wide Area BS

For a *RIB* operating in bands n1, n3, n8, n65 emissions shall not exceed the limits specified in table 4.3.13.2.2-1.

Table 4.3.13.2.2-1: Wide Area BS operating band unwanted emission limits for n1, n3, n8 and n65

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,2 \text{ MHz}$	$0,015 \text{ MHz} \leq f_{\text{offset}} < 0,215 \text{ MHz}$	-3,2 dBm	30 kHz
$0,2 \text{ MHz} \leq \Delta f < 1 \text{ MHz}$	$0,215 \text{ MHz} \leq f_{\text{offset}} < 1,015 \text{ MHz}$	$-3,2 \text{ dBm} - 15 \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,215 \right) \text{ dB}$	30 kHz
(note 4)	$1,015 \text{ MHz} \leq f_{\text{offset}} < 1,5 \text{ MHz}$	-15,2 dBm	30 kHz
$1 \text{ MHz} \leq \Delta f \leq \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$1,5 \text{ MHz} \leq f_{\text{offset}} < \min(10,5 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-2,2 dBm	1 MHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	- 6 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block</i> gap, where the emission limit within <i>sub-block</i> gaps shall be -6 dBm/MHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBU E}}$ the emission limit within the <i>Inter RF Bandwidth</i> gaps is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth</i> gap, where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			
NOTE 4: This frequency range ensures that the range of values of f_{offset} is continuous.			

For a *RIB* operating in Bands n20 and n28, emissions shall not exceed the limits specified in table 4.3.13.2.2-2.

Table 4.3.13.2.2-2: Wide Area BS operating band unwanted emission limits for bands n20 and n28

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$3,8 \text{ dBm} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-3,2 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-7 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -7 dBm/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUE}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

For a *RIB* operating in Bands n7, n38, n40, n41, n50, n75 emissions shall not exceed the limits specified in table 4.3.13.2.2-3.

Table 4.3.13.2.2-3: Wide Area BS operating band unwanted emission limits for n7, n38, n40, n41, n50, n75

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$3,8 \text{ dBm} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-3,2 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-6 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -6 dBm/MHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUE}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

For a *RIB* operating in Bands n77 and n78 emissions shall not exceed the limits specified in table 4.3.13.2.2-4.

Table 4.3.13.2.2-4: Wide Area BS operating band unwanted emission limits for bands n77 and n78

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$4 \text{ dBm} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-3 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-6 dBm (note 3)	1 MHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> , the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the contribution from the far-end <i>sub-block</i> shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -6 dBm/MHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> , where the contribution from the far-end <i>sub-block</i> or RF Bandwidth shall be scaled according to the <i>measurement bandwidth</i> of the near-end <i>sub-block</i> or RF Bandwidth.			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

4.3.13.2.3 Medium Range BS

For Medium Range *BS class* in NR bands $\leq 3 \text{ GHz}$, emissions shall not exceed the limits specified in tables 4.3.13.2.3-1 and 4.3.13.2.3-3.

For Medium Range *BS class* in $3 \text{ GHz} < \text{NR bands} \leq 4,2 \text{ GHz}$, emissions shall not exceed the limits specified in tables 4.3.13.2.3-2 and 4.3.13.2.3-4.

Table 4.3.13.2.3-1: Medium Range BS operating band unwanted emission limits, $40 < P_{\text{rated,c,TRP}} \leq 47 \text{ dBm}$ (NR bands $\leq 3 \text{ GHz}$)

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$P_{\text{rated,c,TRP}} - 51,2 \text{ dB} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	$P_{\text{rated,c,TRP}} - 58,2 \text{ dB}$	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	$\text{Min}(P_{\text{rated,c,TRP}} - 60 \text{ dB}, -16 \text{ dBm})$ (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be $\text{Min}(P_{\text{rated,c,TRP}} - 60 \text{ dB}, -16 \text{ dBm})/100 \text{ kHz}$.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

**Table 4.3.13.2.3-2: Medium Range BS operating band unwanted emission limits,
40 < P_{rated,c,TRP} ≤ 47 dBm (3 GHz < NR bands ≤ 4,2 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$P_{rated,c,TRP} - 51\text{ dB} - \frac{7}{5} \times \left(\frac{f_{offset}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	P _{rated,c,TRP} - 58 dB	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	Min(P _{rated,c,TRP} - 60 dB, -16 dBm) (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be Min(P _{rated,c,TRP} - 60 dB, -16 dBm)/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

**Table 4.3.13.2.3-3: Medium Range BS operating band unwanted emission limits,
P_{rated,c,TRP} ≤ 40 dBm (NR bands ≤ 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$-11,2\text{ dBm} - \frac{7}{5} \times \left(\frac{f_{offset}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	-18,2 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	-20 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -20 dBm/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

**Table 4.3.13.2.3-4: Medium Range BS operating band unwanted emission limits,
P_{rated,c,TRP} ≤ 40 dBm (3 GHz < NR bands ≤ 4,2 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f _{offset}	Limit (notes 1 and 2)	Measurement bandwidth
0 MHz ≤ Δf < 5 MHz	0,05 MHz ≤ f _{offset} < 5,05 MHz	$-11\text{ dBm} - \frac{7}{5} \times \left(\frac{f_{offset}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
5 MHz ≤ Δf < min(10 MHz, Δf _{max})	5,05 MHz ≤ f _{offset} < min(10,05 MHz, f _{offset_max})	-18 dBm	100 kHz
10 MHz ≤ Δf ≤ Δf _{max}	10,05 MHz ≤ f _{offset} < f _{offset_max}	-20 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is Δf ≥ 10 MHz from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -20 dBm/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> < 2 × Δf _{OBUE} the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when Δf _{max} < 10 MHz.			

4.3.13.2.4 Local Area BS

For Local Area *BS class* in NR bands ≤ 3 GHz, emissions shall not exceed the limits specified in table 4.3.13.2.4-1.

For Local Area *BS class* in $3 \text{ GHz} < \text{NR bands} \leq 4,2 \text{ GHz}$, emissions shall not exceed the limits specified in table 4.3.13.2.4-2.

**Table 4.3.13.2.4-1: Local Area BS operating band unwanted emission limits
(NR bands ≤ 3 GHz)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-19,2 \text{ dBm} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-26,2 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-28 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -28 dBm/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

**Table 4.3.13.2.4-2: Local Area BS operating band unwanted emission limits
($3 \text{ GHz} < \text{NR bands} \leq 4,2 \text{ GHz}$)**

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit (notes 1 and 2)	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 5 \text{ MHz}$	$0,05 \text{ MHz} \leq f_{\text{offset}} < 5,05 \text{ MHz}$	$-19 \text{ dBm} - \frac{7}{5} \times \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0,05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq \Delta f < \min(10 \text{ MHz}, \Delta f_{\text{max}})$	$5,05 \text{ MHz} \leq f_{\text{offset}} < \min(10,05 \text{ MHz}, f_{\text{offset}_{\text{max}}})$	-26 dBm	100 kHz
$10 \text{ MHz} \leq \Delta f \leq \Delta f_{\text{max}}$	$10,05 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	-28 dBm (note 3)	100 kHz
NOTE 1: For a BS supporting <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the emission limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> . Exception is $\Delta f \geq 10 \text{ MHz}$ from both adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> , where the emission limit within <i>sub-block gaps</i> shall be -28 dBm/100 kHz.			
NOTE 2: For a <i>multi-band RIB</i> with <i>Inter RF Bandwidth gap</i> $< 2 \times \Delta f_{\text{OBUe}}$ the emission limit within the <i>Inter RF Bandwidth gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> or RF Bandwidth on each side of the <i>Inter RF Bandwidth gap</i> .			
NOTE 3: The requirement is not applicable when $\Delta f_{\text{max}} < 10 \text{ MHz}$.			

4.3.13.2.5 Additional limits

For co-existence with FSS/FS the emissions for *BS type I-O*, operating in bands n77 and n78, shall not exceed the limits specified in table 4.3.13.2.5-1.

Table 4.3.13.2.5-1: Additional operating band unwanted emission limits for bands n77 and n78

Frequency range	Limit	Measurement bandwidth
3 800 MHz to 3 805 MHz	16 dBm	5 MHz
3 805 MHz to 3 810 MHz	12 dBm	5 MHz
3 810 MHz to 3 840 MHz	1 dBm	5 MHz
Above 3 840 MHz	-14 dBm	5 MHz

NOTE 1: For a BS operating in band 20, additional limits for protection of DTT are described in clause 6.7.4.5.1.6.2 in ETSI TS 138 141-2 [2]. This statement is provided for information and does not have any impact on the conformance requirements or essential radio test suites in the present document.

NOTE 2: For BS operating in bands 50, 51, 75 and 76 additional emission limits that might be applicable in the OBUE frequency domain are specified in clause 4.3.15.2.4.

4.3.13.3 Limits for BS type 2-O

The power of unwanted emissions shall not exceed the limits specified in table 4.3.13.3-1, where:

- Δf is the separation between the *contiguous transmission bandwidth* edge frequency and the nominal -3 dB point of the measuring filter closest to the *contiguous transmission bandwidth* edge.
- f_{offset} is the separation between the *contiguous transmission bandwidth* edge frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\text{max}}}$ is the offset to the frequency Δf_{OBUE} outside the downlink *operating band*, where Δf_{OBUE} is defined in table 4.3.13.3-1.

In addition, inside any *sub-block gap* for a *RIB* operating in a *non-contiguous spectrum*, the power of unwanted emissions shall not exceed the cumulative sum of the limits specified for the adjacent *sub-blocks* on each side of the *sub-block gap*. The limit for each *sub-block* is specified in the table 4.3.13.3-1, where in this case:

- Δf is the separation between the *sub-block* edge frequency and the nominal -3 dB point of the measuring filter closest to the *sub-block* edge.
- f_{offset} is the separation between the *sub-block* edge frequency and the centre of the measuring filter.
- $f_{\text{offset}_{\text{max}}}$ is equal to the *sub-block gap* bandwidth minus half of the bandwidth of the measuring filter.
- Δf_{max} is equal to $f_{\text{offset}_{\text{max}}}$ minus half of the bandwidth of the measuring filter.

Table 4.3.13.3-1: OBUE limits applicable in the frequency range 24 250 MHz to 27 500 MHz

Frequency offset of measurement filter -3 dB point, Δf	Frequency offset of measurement filter centre frequency, f_{offset}	Limit	Measurement bandwidth
$0 \text{ MHz} \leq \Delta f < 0,1 \times \text{BW}_{\text{contiguous}}$	$0,5 \text{ MHz} \leq f_{\text{offset}} < 0,1 \times \text{BW}_{\text{contiguous}} + 0,5 \text{ MHz}$	$\text{Min}(-2,3 \text{ dBm}, \text{Max}(P_{\text{rated},t,\text{TRP}} - 32,3 \text{ dB}, -9,3 \text{ dBm}))$	1 MHz
$0,1 \times \text{BW}_{\text{contiguous}} \leq \Delta f < \Delta f_{\text{B}}$	$0,1 \times \text{BW}_{\text{contiguous}} + 0,5 \text{ MHz} \leq f_{\text{offset}} < \Delta f_{\text{B}} + 0,5 \text{ MHz}$	$\text{Min}(-13 \text{ dBm}, \text{Max}(P_{\text{rated},t,\text{TRP}} - 43 \text{ dB}, -20 \text{ dBm}))$	1 MHz
$\Delta f_{\text{B}} \leq \Delta f < \Delta f_{\text{max}}$	$\Delta f_{\text{B}} + 0,5 \text{ MHz} \leq f_{\text{offset}} < f_{\text{offset}_{\text{max}}}$	$\text{Min}(-5 \text{ dBm}, \text{Max}(P_{\text{rated},t,\text{TRP}} - 33 \text{ dB}, -10 \text{ dBm}))$	10 MHz
NOTE 1: For <i>non-contiguous spectrum</i> operation within any <i>operating band</i> the limit within <i>sub-block gaps</i> is calculated as a cumulative sum of contributions from adjacent <i>sub-blocks</i> on each side of the <i>sub-block gap</i> .			
NOTE 2: $\Delta f_{\text{B}} = 2 \times \text{BW}_{\text{contiguous}}$ when $\text{BW}_{\text{contiguous}} \leq 500 \text{ MHz}$, otherwise $\Delta f_{\text{B}} = \text{BW}_{\text{contiguous}} + 500 \text{ MHz}$.			

For the protection of Earth Exploration Satellite Service (EESS), for BS operating in the frequency range 24,25 GHz to 27,5 GHz, the power of unwanted emission shall not exceed the limits in table 4.3.13.3-2.

Table 4.3.13.3-2: BS radiated limits for protection of EEES

Frequency range	Measurement filter centre frequency range	Limit	Measurement Bandwidth
23,6 GHz to 24 GHz	23,7 GHz to 23,9 GHz	-3 dBm	200 MHz
23,6 GHz to 24 GHz	23,7 GHz to 23,9 GHz	-9 dBm	200 MHz
NOTE: Each limit applies according to the schedule defined in [i.25].			

4.3.13.4 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.13 of the present document.

4.3.14 OTA Adjacent Channel Leakage power Ratio (ACLR)

4.3.14.1 Definition and applicability

OTA 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. The power is expressed as TRP.

The OTA ACLR is defined with a square filter of bandwidth equal to the *transmission bandwidth* configuration of the transmitted signal (BW_{Config}) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables in clause 4.2.14.2.3.

The requirement shall be applied per RIB during the *transmitter ON period*.

The requirements shall apply outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth* whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer's specification.

For both *BS type 1-O* and *BS type 2-O*, for a *RIB* operating in multi-carrier or contiguous CA, the OTA ACLR requirements in clause 4.3.14.2 apply to *BS channel bandwidths* of the outermost carrier.

For *BS type 1-O*, for a *RIB* operating in a *non-contiguous spectrum*, the OTA ACLR requirements in clause 4.3.14.2.3 shall apply inside *sub-block gaps* for the frequency ranges defined in table 4.3.14.2.3-2, while the OTA CACLR requirement in clause 4.3.14.2.3 shall apply in *sub-block gaps* for the frequency ranges defined in table 4.3.14.2.3-3. In addition, for a *multi-band RIB*, the OTA ACLR requirement in clause 4.3.14.2.3 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 4.3.14.2.3-2, while the CACLR requirement in clause 4.3.14.2.3 shall apply in *Inter RF Bandwidth gaps* for the frequency ranges defined in table 4.3.14.2.3-3.

For *BS type 2-O*, for a *RIB* operating in a *non-contiguous spectrum*, the OTA ACLR requirements in clause 4.3.14.2.3 shall apply inside any *sub-block gap* for the frequency ranges defined in table 4.3.14.2.3-5, while the CACLR requirement in clause 4.3.14.2.3 shall apply in *sub-block gaps* for the frequency ranges defined in table 4.3.14.2.3-6.

The OTA CACLR in a *sub-block gap* and *Inter RF Bandwidth gap* is the ratio of:

- a) the sum of the filtered mean power centred on the assigned channel frequencies for the two carriers adjacent to each side of the *sub-block gap* or the *Inter RF Bandwidth gap*; and
- b) the filtered mean power centred on a frequency channel adjacent to one of the respective *sub-block* edges or *Base Station RF Bandwidth edges*.

4.3.14.2 Limits

4.3.14.2.1 General

The absolute limits in clause 4.3.14.2.2 or the ACLR/CACLR relative limits in clause 4.3.14.2.3, whichever is less stringent, shall apply.

4.3.14.2.2 Absolute limits

For *BS Type 1-O*, the filtered mean power centred on an adjacent channel frequency shall not exceed the absolute basic limit in table 4.3.14.2.2-1.

Table 4.3.14.2.2-1: BS type 1-O ACLR/CACLR absolute limit

BS class	OTA ACLR absolute limit
Wide Area BS	-6 dBm/MHz
Medium Range BS	-16 dBm/MHz
Local Area BS	-23 dBm/MHz

For *BS Type 2-O*, the filtered mean power centred on an adjacent channel frequency shall not exceed the absolute basic limit in table 4.3.14.2.2-2.

Table 4.3.14.2.2-2: BS type 2-O ACLR absolute limit

BS class	ACLR absolute limit
Wide-area BS	-10,3 dBm/MHz
Medium-range BS	-17,3 dBm/MHz
Local-area BS	-17,3 dBm/MHz

4.3.14.2.3 Relative Limits

For *BS Type 1-O*, for operation in paired and unpaired spectrum, the OTA ACLR shall not be less than the OTA ACLR limit specified in table 4.3.14.2.3-1.

Table 4.3.14.2.3-1: BS type 1-O ACLR limit

BS channel bandwidth of lowest/highest NR carrier transmitted BW_{Channel} (MHz)	BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted	Assumed adjacent channel carrier (informative)	Filter on the adjacent channel frequency and filter bandwidth	OTA ACLR limit (0 GHz to 3 GHz)	OTA ACLR limit (3 GHz to 4,2 GHz)
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100	BW_{Channel}	NR of same BW (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$2 \times BW_{\text{Channel}}$	NR of same BW (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$BW_{\text{Channel}}/2 + 2,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	44 dB (note 3)	43,8 dB (note 3)
	$BW_{\text{Channel}}/2 + 7,5 \text{ MHz}$	5 MHz E-UTRA	Square (4,5 MHz)	44 dB (note 3)	43,8 dB (note 3)
NOTE 1: BW_{Channel} and BW_{Config} are the BS channel bandwidth and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency.					
NOTE 2: With SCS that provides largest transmission bandwidth configuration (BW_{Config}).					
NOTE 3: The requirements are applicable when the band is also defined for E-UTRA or UTRA.					

For *BS Type 1-O*, for operation in a *non-contiguous spectrum* or multiple bands, the OTA ACLR shall not be less than the OTA ACLR limit specified in table 4.3.14.2.3-2.

Table 4.3.14.2.3-2: *BS type 1-O ACLR limit in non-contiguous spectrum or multiple bands*

<i>BS channel bandwidth of lowest/highest NR carrier transmitted</i> BW_{Channel} (MHz)	<i>Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)</i>	<i>BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)</i>	<i>Assumed adjacent channel carrier</i>	<i>Filter on the adjacent channel frequency and filter bandwidth</i>	<i>OTA ACLR limit (0 GHz to 3 GHz)</i>	<i>OTA ACLR limit (3 GHz to 4,2 GHz)</i>
5, 10, 15, 20	$W_{\text{gap}} \geq 15$ (note 3) $W_{\text{gap}} \geq 45$ (note 4)	2,5 MHz	5 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$W_{\text{gap}} \geq 20$ (note 3) $W_{\text{gap}} \geq 50$ (note 4)	7,5 MHz	5 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
25, 30, 40, 50, 60, 70, 80, 90, 100	$W_{\text{gap}} \geq 60$ (note 4) $W_{\text{gap}} \geq 30$ (note 3)	10 MHz	20 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$W_{\text{gap}} \geq 80$ (note 4) $W_{\text{gap}} \geq 50$ (note 3)	30 MHz	20 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB

NOTE 1: BW_{Config} is the *transmission bandwidth* configuration of the assumed adjacent channel carrier.

NOTE 2: With SCS that provides largest *transmission bandwidth* configuration (BW_{Config}).

NOTE 3: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz.

NOTE 4: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz.

The OTA CACLR shall not be less than the limit specified in table 4.3.14.2.3-3.

Table 4.3.14.2.3-3: *BS type 1-O CACLR limit*

<i>BS channel bandwidth of lowest/highest NR carrier transmitted</i> BW_{Channel} (MHz)	<i>Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)</i>	<i>BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)</i>	<i>Assumed adjacent channel carrier</i>	<i>Filter on the adjacent channel frequency and filter bandwidth</i>	<i>OTA CACLR limit (0 GHz to 3 GHz)</i>	<i>OTA CACLR limit (3 GHz to 4,2 GHz)</i>
5, 10, 15, 20	$5 \leq W_{\text{gap}} < 15$ (note 3) $5 \leq W_{\text{gap}} < 45$ (note 4)	2,5 MHz	5 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$10 < W_{\text{gap}} < 20$ (note 3) $10 \leq W_{\text{gap}} < 50$ (note 4)	7,5 MHz	5 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
25, 30, 40, 50, 60, 70, 80, 90, 100	$20 \leq W_{\text{gap}} < 60$ (note 4) $20 \leq W_{\text{gap}} < 30$ (note 3)	10 MHz	20 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB
	$40 < W_{\text{gap}} < 80$ (note 4) $40 \leq W_{\text{gap}} < 50$ (note 3)	30 MHz	20 MHz NR (note 2)	Square (BW_{Config})	44 dB	43,8 dB

BS channel bandwidth of lowest/highest NR carrier transmitted BW_{Channel} (MHz)	Sub-block or Inter RF Bandwidth gap size (W_{gap}) where the limit applies (MHz)	BS adjacent channel centre frequency offset below or above the sub-block or Base Station RF Bandwidth edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and filter bandwidth	OTA CACLR limit (0 GHz to 3 GHz)	OTA CACLR limit (3 GHz to 4,2 GHz)
NOTE 1: BW _{Config} is the <i>transmission bandwidth</i> configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides largest <i>transmission bandwidth</i> configuration (BW _{Config}). NOTE 3: Applicable in case the BS channel bandwidth of the NR carrier transmitted at the other edge of the gap is 5, 10, 15, 20 MHz. NOTE 4: Applicable in case the BS channel bandwidth of the NR carrier transmitted at the other edge of the gap is 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz.						

For BS Type 2-O, the OTA ACLR shall not be less than the limit specified in table 4.3.14.2.3-4.

Table 4.3.14.2.3-4: BS type 2-O ACLR limit

BS channel bandwidth of lowest/highest NR carrier transmitted BW_{Channel} (MHz)	BS adjacent channel centre frequency offset below the lowest or above the highest carrier centre frequency transmitted	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and filter bandwidth	OTA ACLR limit (dB)
50, 100, 200, 400	BW _{Channel}	NR of same BW (note 2)	Square (BW _{Config})	25,7 (note 3) 23,4 (note 4)
NOTE 1: BW _{Channel} and BW _{Config} are the BS channel bandwidth and transmission bandwidth configuration of the lowest/highest NR carrier transmitted on the assigned channel frequency. NOTE 2: With SCS that provides largest <i>transmission bandwidth</i> configuration (BW _{Config}). NOTE 3: Applicable to bands defined within the frequency spectrum range of 24,25 GHz to 33,4 GHz. NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 GHz to 52,6 GHz.				

For BS Type 2-O, for operation in *non-contiguous spectrum*, the OTA ACLR shall not be less than the limit specified in table 4.3.14.2.3-5.

Table 4.3.14.2.3-5: BS type 2-O ACLR limit in non-contiguous spectrum

BS channel bandwidth of lowest/highest NR carrier transmitted (MHz)	Sub-block gap size (W_{gap}) where the limit applies (MHz)	BS adjacent channel centre frequency offset below or above the sub-block edge (inside the gap)	Assumed adjacent channel carrier	Filter on the adjacent channel frequency and filter bandwidth	OTA ACLR limit (MHz)
50, 100	W _{gap} ≥ 100 (note 5) W _{gap} ≥ 250 (note 6)	25 MHz	50 MHz NR (note 2)	Square (BW _{Config})	25,7 (note 3) 23,4 (note 4)
200, 400	W _{gap} ≥ 400 (note 6) W _{gap} ≥ 250 (note 5)	100 MHz	200 MHz NR (note 2)	Square (BW _{Config})	25,7 (note 3) 23,4 (note 4)
NOTE 1: BW _{Config} is the <i>transmission bandwidth</i> configuration of the assumed adjacent channel carrier. NOTE 2: With SCS that provides the largest <i>transmission bandwidth</i> configuration (BW _{Config}). NOTE 3: Applicable to bands defined within the frequency spectrum range of 24,24 GHz to 33,4 GHz. NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 GHz to 52,6 GHz. NOTE 5: Applicable in case the BS channel bandwidth of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz. NOTE 6: Applicable in case the BS channel bandwidth of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.					

For BS Type 2-O, for operation in a *non-contiguous spectrum*, the CACLR for NR carriers located on either side of the sub-block gap shall be less than the limit specified in table 4.3.14.2.3-6.

Table 4.3.14.2.3-6: *BS type 2-O CACLR limit in non-contiguous spectrum*

<i>BS channel bandwidth of lowest/highest NR carrier transmitted (MHz)</i>	<i>Sub-block gap size (W_{gap}) where the limit applies (MHz)</i>	<i>BS adjacent channel centre frequency offset below or above the sub-block edge (inside the gap)</i>	<i>Assumed adjacent channel carrier</i>	<i>Filter on the adjacent channel frequency and filter bandwidth</i>	<i>OTA CACLR limit (dB)</i>
50, 100	$50 \leq W_{\text{gap}} < 100$ (note 5)	25 MHz	50 MHz NR (note 2)	Square (BW_{Config})	25,7 (note 3)
	$50 \leq W_{\text{gap}} < 250$ (note 6)				23,4 (note 4)
200, 400	$200 \leq W_{\text{gap}} < 400$ (note 6)	100 MHz	200 MHz NR (note 2)	Square (BW_{Config})	25,7 (note 3)
	$200 \leq W_{\text{gap}} < 250$ (note 5)				23,4 (note 4)

NOTE 1: BW_{Config} is the *transmission bandwidth* configuration of the assumed adjacent channel carrier.
NOTE 2: With SCS that provides largest *transmission bandwidth* configuration (BW_{Config}).
NOTE 3: Applicable to bands defined within the frequency spectrum range of 24,24 GHz to 33,4 GHz.
NOTE 4: Applicable to bands defined within the frequency spectrum range of 37 GHz to 52,6 GHz.
NOTE 5: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 50 or 100 MHz.
NOTE 6: Applicable in case the *BS channel bandwidth* of the NR carrier transmitted at the other edge of the gap is 200 or 400 MHz.

4.3.14.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.14 of the present document.

4.3.15 OTA transmitter spurious emissions

4.3.15.1 Definition and applicability

All limits are expressed as mean power.

The OTA transmitter spurious emissions limits are specified as TRP per RIB, except EIRP limits in table 4.3.15.2.5-2 and co-location related limits specified at CLTA output.

The OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to 12,75 GHz or the 5th harmonic of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in clause 4.3.13.1.

NOTE: For bands n7, n38, n41, n77 and n78, the upper limit of the spurious range might be more than 12,75 GHz to comply with the 5th harmonic limit of the downlink *operating band*, as specified in Recommendation ITU-R SM.329-12 [i.4].

For *multi-band RIB* each supported *operating band* and the Δf_{OBUE} MHz around each band are excluded from the OTA transmitter spurious emissions requirements.

The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier). It applies for all transmission modes foreseen by the manufacturer's specification.

The OTA transmitter spurious emission limits for FR2 shall apply from 30 MHz to 2nd harmonic of the upper frequency edge of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in clause 4.3.13.1.

The requirement on the protection of own *BS receiver* of own or different BS shall be applied for NR FDD operation in order to prevent the receivers of own or a different BS of the same band being desensitized by emissions from a *BS type I-O*. This requirement is a co-location requirement as defined in clause 4.9 in ETSI TS 138 104 [3], the power levels are specified at the CLTA output.

Requirements on co-existence shall be applied for the protection of systems operating in frequency ranges other than the BS *downlink operating band*. The limits shall apply as protection of such systems that are deployed in the same geographical area as the BS. Some requirements may apply for the protection of specific equipment (UE, MS and/or BS) or equipment operating in specific systems (GSM, CDMA, UTRA, E-UTRA, NR, etc.). The requirements shall apply at each RIB supporting transmission in the *operating band*.

4.3.15.2 Limits

4.3.15.2.1 General spurious emission limits for BS type 1-O

The TRP of any spurious emission shall not exceed the limits in table 4.3.15.2.1-1.

Table 4.3.15.2.1-1: General OTA BS transmitter spurious emission limits for BS type 1-O

Spurious frequency range	Limit	Measurement bandwidth	Notes
30 MHz to 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz to 12,75 GHz	-30 dBm	1 MHz	Notes 1 and 2
12,75 GHz - 5 th harmonic of the upper frequency edge of the DL <i>operating band</i> in GHz		1 MHz	Notes 1, 2 and 3
NOTE 1: <i>Measurement bandwidths</i> as in Recommendation ITU-R SM.329-12 [i.4], s4.1.			
NOTE 2: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1.			
NOTE 3: This spurious frequency range applies only for <i>operating bands</i> for which the 5 th harmonic of the upper frequency edge of the DL <i>operating band</i> is reaching beyond 12.75 GHz.			

4.3.15.2.2 General spurious emission limits for BS type 2-O

The power of any spurious emission shall not exceed the limits in table 4.3.15.2.2-1.

Table 4.3.15.2.2-1: General OTA BS transmitter spurious emission limits for BS type 2-O

Frequency range (note 4)	Limit	Measurement Bandwidth	Note
30 MHz to 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz to 18 GHz	-30 dBm	1 MHz	Note 1
18 GHz to $F_{\text{step},1}$	-20 dBm	10 MHz	Note 2
$F_{\text{step},1}$ to $F_{\text{step},2}$	-15 dBm	10 MHz	Note 2
$F_{\text{step},2}$ to $F_{\text{step},3}$	-10 dBm	10 MHz	Note 2
$F_{\text{step},4}$ to $F_{\text{step},5}$	-10 dBm	10 MHz	Note 2
$F_{\text{step},5}$ to $F_{\text{step},6}$	-15 dBm	10 MHz	Note 2
$F_{\text{step},6}$ to min(2 nd harmonic of the upper frequency edge of the DL <i>operating band</i> in GHz; 60 GHz)	-20 dBm	10 MHz	Notes 2 and 3
NOTE 1: Bandwidth as in Recommendation ITU-R SM.329-12 [i.4], s4.1			
NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [i.7], annex 2.			
NOTE 3: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1.			
NOTE 4: The step frequencies $F_{\text{step},X}$ are defined in table 4.3.15.2.2-2.			

Table 4.3.15.2.2-2: Step frequencies for defining the BS radiated Tx spurious emission limits in FR2

Operating band	F _{step,1} (GHz)	F _{step,2} (GHz)	F _{step,3} (GHz) (note 2)	F _{step,4} (GHz) (note 2)	F _{step,5} (GHz)	F _{step,6} (GHz)
n258, n257 (note 3)	18	21	22,75	29	30,75	40,5
NOTE 1: F _{step,X} are based on ERC Recommendation 74-01 [i.7], annex 2. NOTE 2: F _{step,3} and F _{step,4} are aligned with the values for Δf _{OBUE} in table 4.3.13.1-1. NOTE 3: For operation in Band n257 within 26,5 GHz to 27,5 GHz, the same limits and step frequencies apply as for Band n258.						

4.3.15.2.3 Limits for protection of BS receiver for BS type 1-O

This requirement shall be applied for NR FDD operation in order to prevent the receivers of own or a different BS of the same band being desensitized by emissions from a BS type 1-O.

This requirement is a co-location requirement as defined in clause 4.12 in ETSI TS 138 141-2 [2], the power levels are specified at the CLTA output.

The total power of any spurious emission from both polarizations of the CLTA connector output shall not exceed the limits in table 4.3.15.2.3-1.

Table 4.3.15.2.3-1: BS type 1-O OTA spurious emissions limits for protection of the BS receiver

BS class	Frequency range	Limit for bands below 3 GHz	Limit for bands between 3 and 4,2 GHz	Measurement bandwidth
Wide Area BS	F _{UL_low} to F _{UL_high}	-113,9 dBm	-113,7 dBm	100 kHz
Medium Range BS		-108,9 dBm	-108,7 dBm	
Local Area BS		-105,9 dBm	-105,7 dBm	

4.3.15.2.4 Limits for co-existence with systems operating in other frequency bands for BS type 1-O

The power of any spurious emission shall not exceed the limits in table 4.3.15.2.4-1 for a BS where requirements for co-existence with the system listed in the first column apply. For a *multi-band RIB*, the exclusions and conditions in the Exclusions and Conditions column of table 4.3.15.2.4-1 apply for each supported *operating band*.

Table 4.3.15.2.4-1: Spurious emissions limits for BS type 1-O for co-existence with systems operating in other frequency bands

Protected system	Frequency range for co-existence requirement	Limit	Measurement bandwidth	Exclusions and Conditions
GSM900	921 MHz to 960 MHz	-45,4 dBm	100 kHz	This requirement shall not apply to BS operating in band n8.
	876 MHz to 915 MHz	-49,4 dBm	100 kHz	For the frequency range 880 MHz to 915 MHz, this requirement shall not apply to BS operating in band n8, since it is already covered by the requirement in clause 4.3.15.2.3.
DCS1800	1 805 MHz to 1 880 MHz	-35,4 dBm	100 kHz	This requirement shall not apply to BS operating in band n3.
	1 710 MHz to 1 785 MHz	-49,4 dBm	100 kHz	This requirement shall not apply to BS operating in band n3, since it is already covered by the requirement in clause 4.3.15.2.3.

Protected system	Frequency range for co-existence requirement	Limit	Measurement bandwidth	Exclusions and Conditions
UTRA FDD Band I or E-UTRA Band 1 or NR Band n1	2 110 MHz to 2 170 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n1 or n65.
	1 920 MHz to 1 980 MHz	-37,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n1 or n65, since it is already covered by the requirement in clause 4.3.15.2.3.
UTRA FDD Band III or E-UTRA Band 3 or NR Band n3	1 805 MHz to 1 880 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n3.
	1 710 MHz to 1 785 MHz	-37,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n3, since it is already covered by the requirement in clause 4.3.15.2.3.
UTRA FDD Band VIII or E-UTRA Band 8 or NR Band n8	925 MHz to 960 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n8.
	880 MHz to 915 MHz	-37,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n8, since it is already covered by the requirement in clause 4.3.15.2.3.
UTRA FDD Band XX or E-UTRA Band 20 or NR Band n20	791 MHz to 821 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n20 or n28.
	832 MHz to 862 MHz	-37,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n20, since it is already covered by the requirement in clause 4.3.15.2.3.
E-UTRA Band 28 or NR Band n28	758 MHz to 803 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n20 or n28.
	703 MHz to 748 MHz	-37,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n28, since it is already covered by the requirement in clause 4.3.15.2.3.
UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38	2 570 MHz to 2 620 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n38.
UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40	2 300 MHz to 2 400 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n40.
E-UTRA Band 41 or NR Band n41	2 496 MHz to 2 690 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n41.
E-UTRA Band 50 or NR Band n50	1 432 MHz to 1 517 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n74, n75 or n76.
E-UTRA Band 51 or NR Band n51	1 427 MHz to 1 432 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n75 or n76.
E-UTRA Band 65 or NR Band n65	2 110 MHz to 2 200 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in band n1 or n65.
	1 920 MHz to 2 010 MHz	-37,4 dBm	1 MHz	For BS operating in Band n1, it shall apply for 1 980 MHz to 2 010 MHz, while the rest is covered in clause 4.3.15.2.3. This requirement shall not apply to BS operating in band n65, since it is already covered by the requirement in clause 4.3.15.2.3.
E-UTRA Band 75 or NR Band n75	1 432 MHz to 1 517 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n74, n75 or n76.
E-UTRA Band 76 or NR Band n76	1 427 MHz to 1 432 MHz	-40,4 dBm	1 MHz	This requirement shall not apply to BS operating in Band n50, n51, n75 or n76.
NR Band n77	3 300 MHz to 4 200 MHz	-40 dBm	1 MHz	This requirement shall not apply to BS operating in Band n77 and n 78.
NR Band n78	3 300 MHz to 3 800 MHz	-40 dBm	1 MHz	This requirement shall not apply to BS operating in Band n77 and n78.

4.3.15.2.5 Additional limits

The following limits shall apply to BS operating in Band n50 and n75 within 1 432 MHz to 1 452 MHz, and in Band n51 and Band n76. The limits are specified in table 4.3.15.2.5-1 and shall apply also at the frequency range from Δf_{OBUE} below the lowest frequency of the BS downlink *operating band* up to Δf_{OBUE} above the highest frequency of the BS downlink *operating band*.

Table 4.3.15.2.5-1: Additional unwanted emission limit for BS operating in bands n50 and n75 within 1 432 MHz to 1 452 MHz, and in bands n51 and n76

Filter centre frequency, filter	Limit	Measurement bandwidth
$F_{\text{filter}} = 1\,413,5\text{ MHz}$	-42 dBm	27 MHz

The following limit shall apply to BS operating in bands n50 and n75 within 1 492 MHz to 1 517 MHz. The maximum level of emissions, measured as EIRP, on centre frequencies F_{filter} with filter bandwidth according to table 4.3.15.2.5-2, shall not exceed the EIRP limit, in any direction.

Table 4.3.15.2.5-2: Operating band n50 and n75 emission limits above 1 518 MHz

Filter centre frequency, F_{filter}	Limit (EIRP)	Measurement bandwidth
$1\,518,5\text{ MHz} \leq F_{\text{filter}} \leq 1\,519,5\text{ MHz}$	-0,8 dBm	1 MHz
$1\,520,5\text{ MHz} \leq F_{\text{filter}} \leq 1\,558,5\text{ MHz}$	-30 dBm	1 MHz

For protection of Earth Exploration Satellite Service (EESS), for BS operating in the frequency range 24,25 MHz to 27,5 GHz, the power of any spurious emissions shall not exceed the limits in table 4.3.15.2.5-3.

Table 4.3.15.2.5-3: BS spurious emissions limits for protection of EESS

Frequency range	Limit	Measurement Bandwidth
23,6 GHz to 24 GHz	-3 dBm	200 MHz
23,6 GHz to 24 GHz	-9 dBm	200 MHz
NOTE: Each limit applies according to the schedule defined in [i.25].		

4.3.15.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.15 of the present document.

4.3.16 Radiated transmit power

4.3.16.1 Definition and applicability

This is an output power accuracy requirement defined at the RIB during the *transmitter ON period*. Radiated transmit power is defined as the EIRP level for a *beam* at a specific *beam peak direction*.

For each *beam*, the requirement is based on following information included in the technical documentation of the radio equipment:

- *beam* identifier (D.3)
- *reference beam direction pair* (D.8)
- *rated beam EIRP* (D.11) at the *beam's* reference direction pair
- *OTA peak directions set* (D.9)
- *beam direction pairs* at the maximum steering directions (D.10) and their associated *rated beam EIRP* and *beamwidth(s)* for reference *beam direction pair*
- maximum steering directions (D.12)

NOTE: For a *beam identifier* and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the BS radiates at the associated *beam peak direction* during the *transmitter ON period*.

For *operating bands* where the supported *fractional bandwidth* (FBW) is not less than 6 %, the BS can support two rated beam EIRP:

- $P_{\text{rated,c,FBWlow}}$ for lower supported frequency range (D.57); and
- $P_{\text{rated,c,FBWhigh}}$ for higher supported frequency range (D.58).

For frequencies in between F_{FBWlow} and F_{FBWhigh} the rated carrier EIRP is:

- $P_{\text{rated,c,FBWlow}}$, for the carrier whose carrier frequency is within frequency range:

$$F_{\text{FBWlow}} \leq f < (F_{\text{FBWlow}} + F_{\text{FBWhigh}}) / 2$$

- $P_{\text{rated,c,FBWhigh}}$, for the carrier whose carrier frequency is within frequency range:

$$(F_{\text{FBWlow}} + F_{\text{FBWhigh}}) / 2 \leq f \leq F_{\text{FBWhigh}}$$

4.3.16.2 Limits

For each conformance *beam direction pair*, the EIRP shall remain within the values provided in table 4.2.16.2-1, relative to the *rated beam EIRP* value(s).

Table 4.2.16.2-1: Requirements for radiated transmit power

BS type	Frequency	Normal test environment	Extreme test environment
1-H	$f \leq 3 \text{ GHz}$	$\pm 3,3 \text{ dB}$	N/A
	$3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 3,5 \text{ dB}$	
1-O	$f \leq 3 \text{ GHz}$	$\pm 3,3 \text{ dB}$	$\pm 5,2 \text{ dB}$
	$3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 3,5 \text{ dB}$	$\pm 5,3 \text{ dB}$
2-O	$24,15 \text{ GHz} < f \leq 29,5 \text{ GHz}$	$\pm 5,1 \text{ dB}$	$\pm 7,6 \text{ dB}$
	$37 \text{ GHz} < f \leq 40 \text{ GHz}$	$\pm 5,4 \text{ dB}$	$\pm 7,8 \text{ dB}$

4.3.16.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.16 of the present document.

4.3.17 OTA Base Station output power

4.3.17.1 Definition and applicability

This is an output power accuracy requirement defined at the RIB during the *transmitter ON period*. OTA BS output power is expressed as TRP.

NOTE: The *BS class* specific *rated carrier output power* limits are described in ETSI TS 138 141-2 [2], clause 6.3.1.

4.3.17.2 Limits

The TRP shall remain within the values provided in table 4.2.17.2-1, relative to the *rated carrier TRP*, $P_{\text{rated,c,TRP}}$.

Table 4.2.17.2-1: Requirements OTA Base Station output power

BS type	Frequency	Normal test environment
1-O	$f \leq 3 \text{ GHz}$	$\pm 3,4 \text{ dB}$
	$3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 3,5 \text{ dB}$
2-O	$24,25 \text{ GHz} < f \leq 29,5 \text{ GHz}$	$\pm 5,1 \text{ dB}$

4.3.17.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.17 of the present document.

4.3.18 OTA transmitter intermodulation

4.3.18.1 Definition and applicability

The OTA transmitter intermodulation requirement is a measure of the capability of the transmitter unit to inhibit the generation of signals in its non-linear elements caused by the presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station. The requirement applies during the *transmitter ON period* and the *transmitter transient period*.

The requirement applies at each RIB supporting transmission in the *operating band*.

The transmitter intermodulation level is the *total radiated power* of the intermodulation products when an interfering signal is injected into the CLTA.

For *BS type 1-O*, the transmitter intermodulation requirement is captured by the co-location transmitter intermodulation scenario case, in which the interfering signal is injected into the CLTA.

The OTA transmitter intermodulation requirement is not applicable for *BS type 2-O*.

4.3.18.2 Limits

4.3.18.2.1 BS type 1-O

The transmitter intermodulation level shall not exceed the TRP unwanted emission limits specified for OTA transmitter spurious emission in clause 4.3.15.2.1, OTA out-of-band unwanted emissions in clause 4.3.13.2.1 and OTA ACLR in clause 4.3.14.2.1 in the presence of a wanted signal and an interfering signal, defined in table 4.3.18.2.1-1.

The requirement is applicable outside the *Base Station RF Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For RIBs supporting operation in a *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block edges*.

For RIBs supporting operation in multiple *operating bands*, the requirement shall apply relative to the *Base Station RF Bandwidth edges* of each *operating band*. In case the *inter RF Bandwidth gap* is less than $3 \times BW_{\text{Channel}}$ MHz (where BW_{Channel} is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the *inter RF Bandwidth gap*.

Table 4.3.18.2.1-1: Interfering and wanted signals for the OTA transmitter intermodulation requirement

Parameter	Description
Wanted signal	NR single or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers.
Interfering signal type	NR signal, the minimum <i>BS channel bandwidth</i> (BW_{Channel}) with 15 kHz SCS of the band defined in clause 5.3.5 in ETSI TS 138 104 [3].
Interfering signal power level	$\min(46 \text{ dBm}, P_{\text{rated,t,TRP}})$
Interfering signal centre frequency offset from the lower (upper) edge of the wanted signal or edge of <i>sub-block</i> inside a gap	$f_{\text{offset}} = \pm BW_{\text{Channel}} \left(n - \frac{1}{2} \right)$, for $n=1, 2$ and 3
NOTE 1: Interfering signal positions that are partially or completely outside of any downlink <i>operating band</i> of the BS are excluded from the requirement unless the interfering signal positions fall within the frequency range of adjacent downlink <i>operating bands</i> listed in table 1-2.	
NOTE 2: For <i>BS Type 1-O</i> supporting dual polarization, the interfering signal power shall be equally divided between supported polarizations at the CLTA interfaces.	

4.3.18.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.18 of the present document.

4.3.19 OTA receiver spurious emissions

4.3.19.1 Definition and applicability

The OTA RX spurious emission is the power of the emissions radiated from the antenna array from a receiver unit. All limits are expressed as mean power.

The OTA receiver spurious emission limits for FR1 shall apply from 30 MHz to 12,75 GHz or the 5th harmonic of the downlink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in clause 4.3.13.1.

NOTE: For *bands* n7, n38, n41, n77 and n78, the upper limit of the spurious range might be more than 12,75 GHz in order to comply with the 5th harmonic limit of the uplink *operating band*, as specified in Recommendation ITU-R SM.329-12 [i.4].

For *multi-band RIB* the above exclusion applies for each supported *operating band*.

The OTA receiver spurious emission limits for FR2 shall apply from 30 MHz to 2nd harmonic of the upper frequency edge of the uplink *operating band*, excluding the frequency range from Δf_{OBUE} below the lowest frequency of each supported downlink *operating band*, up to Δf_{OBUE} above the highest frequency of each supported downlink *operating band*, where the Δf_{OBUE} is defined in clause 4.3.2.1.

For a BS operating in FDD, OTA RX spurious emissions requirements do not apply as they are superseded by the OTA TX spurious emissions requirement. This is due to the fact that TX and RX spurious emissions cannot be distinguished in OTA domain.

For a BS operating in TDD, the OTA RX spurious emissions requirement shall apply during the *transmitter OFF period* only.

The metric used to capture OTA receiver spurious emissions for *BS type 1-O* and *BS type 2-O* is *Total Radiated Power* (TRP), with the requirement defined at the RIB.

4.3.19.2 Limits

4.3.19.2.1 BS type 1-O

For RX only *multi-band RIB*, the OTA receiver spurious emissions levels are subject to exclusion zones in each supported *operating band*.

The power of any receiver spurious emission shall not exceed the limits in table 4.3.19.2.2-1.

In addition to the limits in table 4.3.19.2.1-1, the TRP of any spurious emission shall not exceed the limits specified in clauses 4.3.15.2.2, 4.3.15.2.3 and 4.3.15.2.4.

Table 4.3.19.2.1-1: General OTA BS receiver spurious emission limits for BS type 1-O

Spurious frequency range (note 4)	Limits	Measurement bandwidth	Notes
30 MHz to 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz to 12,75 GHz	-30 dBm	1 MHz	Note 1 and note 2
12,75 GHz - 5 th harmonic of the upper frequency edge of the UL <i>operating band</i> in GHz	-30 dBm	1 MHz	Note 1, note 2 and note 3
NOTE 1: <i>Measurement bandwidths</i> as in Recommendation ITU-R SM.329-12 [i.4], s4.1. NOTE 2: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1. NOTE 3: This spurious frequency range applies only to <i>operating bands</i> for which the 5 th harmonic of the upper frequency edge of the UL <i>operating band</i> is reaching beyond 12,75 GHz. NOTE 4: The frequency range from Δf_{OBUE} below the lowest frequency of the BS transmitter <i>operating band</i> to Δf_{OBUE} above the highest frequency of the BS transmitter <i>operating band</i> may be excluded from the requirement. Δf_{OBUE} is defined in clause 4.3.13.1. For <i>multi-band RIBs</i> , the exclusion applies to all supported <i>operating bands</i> .			

4.3.19.2.2 BS type 2-O

The power of any receiver spurious emission shall not exceed the limits in table 4.3.19.2.2-1.

Table 4.3.19.2.2-1: Radiated Rx spurious emission limits for BS type 2-O

Spurious frequency range (note 4)	Limit	Measurement Bandwidth	Note
30 MHz to 1 GHz	-36 dBm	100 kHz	Note 1
1 GHz to 18 GHz	-30 dBm	1 MHz	Note 1
18 GHz to $F_{\text{step},1}$	-20 dBm	10 MHz	Note 2
$F_{\text{step},1}$ to $F_{\text{step},2}$	-15 dBm	10 MHz	Note 2
$F_{\text{step},2}$ to $F_{\text{step},3}$	-10 dBm	10 MHz	Note 2
$F_{\text{step},4}$ to $F_{\text{step},5}$	-10 dBm	10 MHz	Note 2
$F_{\text{step},5}$ to $F_{\text{step},6}$	-15 dBm	10 MHz	Note 2
$F_{\text{step},6} \leftrightarrow \min(2^{\text{nd}} \text{ harmonic of the upper frequency edge of the UL } \textit{operating band} \text{ in GHz; } 60 \text{ GHz})$	-20 dBm	10 MHz	Notes 2 and 3
NOTE 1: Bandwidth as in Recommendation ITU-R SM.329-12 [i.4], s4.1 NOTE 2: Limit and bandwidth as in ERC Recommendation 74-01 [i.7], annex 2. NOTE 3: Upper frequency as in Recommendation ITU-R SM.329-12 [i.4], s2.5 table 1. NOTE 4: The step frequencies $F_{\text{step},X}$ are defined in table 4.3.19.2.2-2.			

Table 4.3.19.2.2-2: Step frequencies for defining the radiated Rx spurious emission limits for BS type 2-O

Operating band	$F_{\text{step},1}$ (GHz)	$F_{\text{step},2}$ (GHz)	$F_{\text{step},3}$ (GHz)	$F_{\text{step},4}$ (GHz)	$F_{\text{step},5}$ (GHz)	$F_{\text{step},6}$ (GHz)
n258, n257 (note)	18	21	22,75	29	30,75	40,5
NOTE: $F_{\text{step},X}$ are the same as in table 4.3.15.2.2-2 for transmitter spurious emissions.						

In addition, for protection of Earth Exploration Satellite Service (EESS), for BS operating in frequency range 24,25 GHz to 27,5 GHz, the power of any receiver spurious emission shall not exceed the limits in table 4.3.19.2.2-3.

Table 4.3.19.2.2-3: Receiver spurious emission limits for protection of EESS

Frequency range	Limit	Measurement Bandwidth
23,6 GHz to 24 GHz	-3 dBm	200 MHz
23,6 GHz to 24 GHz	-9 dBm	200 MHz
NOTE: Each limit applies according to the schedule defined in [i.25].		

4.3.19.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.19 of the present document.

4.3.20 OTA In-band blocking

4.3.20.1 Definition and applicability

The OTA in-band blocking characteristics is a measure of the receiver's ability to receive a OTA wanted signal at its assigned channel in the presence of an unwanted OTA interferer, which is an NR signal for general blocking or an NR signal with one RB for narrowband blocking.

4.3.20.2 Limits

4.3.20.2.1 BS type 1-O

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and:

- when the wanted signal is based on $EIS_{REFSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *OTA REFSSENS RoAoA*;
- when the wanted signal is based on $EIS_{minSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel, with OTA wanted and OTA interfering signal specified in table 4.3.20.2.1-2, table 4.3.20.2.1-3 and table 4.3.20.2.1-4 for general OTA and narrowband OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.1 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal is further specified in ETSI TS 138 104 [3], annex D.

The OTA in-band blocking requirements apply outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For *BS type 1-O* the OTA in-band blocking requirement shall apply in the in-band blocking frequency range, which is defined within frequency range from $F_{UL_low} - \Delta f_{OOB}$ to $F_{UL_high} + \Delta f_{OOB}$, excluding the downlink frequency range of the *FDD operating band*, where the Δf_{OOB} for *BS type 1-O* is defined in table 4.3.20.2.1-1.

Table 4.3.20.2.1-1: Δf_{OOB} offset for NR operating bands in FR1

BS type	Operating band characteristics	Δf_{OOB} (MHz)
BS type 1-O	$F_{UL_high} - F_{UL_low} < 100$ MHz	20
	$100 \text{ MHz} \leq F_{UL_high} - F_{UL_low} \leq 900$ MHz	60

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA in-band blocking requirements apply also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as twice the interfering signal minimum offset in table 4.3.20.2.1-2. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For *multi-band RIBs*, the OTA in-band blocking requirements apply in the in-band blocking frequency ranges for each supported *operating band*. The requirement shall apply also inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as twice the interfering signal minimum offset in tables 4.3.20.2.1-2 and 4.3.20.2.1-4.

For a RIBs supporting operation in a *non-contiguous spectrum* within any *operating band*, the OTA narrowband blocking requirements apply also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the interfering signal minimum offset in table 4.3.20.2.1-4. The interfering signal offset is defined relative to the *sub-block* edges inside the *sub-block gap*.

For *multi-band RIBs*, the OTA narrowband blocking requirements apply in the narrowband blocking frequency ranges for each supported *operating band*. The requirement shall apply also inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the interfering signal minimum offset in table 4.3.20.2.1-4.

Table 4.3.20.2.1-2: General OTA blocking requirement for BS type 1-0

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm)		Interfering signal mean power (dBm)	Interfering signal centre frequency minimum offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
	$f \leq 3,0$ GHz	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$			
5, 10, 15, 20	EIS _{REFSENS} + 6 dB (note 2 and note 4)		Wide Area BS: -43 - $\Delta_{\text{OTAREFSSENS}}$ Medium Range BS: -38 - $\Delta_{\text{OTAREFSSENS}}$ Local Area BS: -35 - $\Delta_{\text{OTAREFSSENS}}$ (note 2)	$\pm 7,5$	5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 25 RBs
	EIS _{minSENS} + 6 dB (note 3 and note 5)		Wide Area BS: -43 - Δ_{minSENS} Medium Range BS: -38 - Δ_{minSENS} Local Area BS: -35 - Δ_{minSENS} (note 3)		
25,30, 40, 50, 60, 70, 80, 90, 100	EIS _{REFSENS} + 6 dB (note 2 and note 4)		Wide Area BS: -43 - $\Delta_{\text{OTAREFSSENS}}$ Medium Range BS: -38 - $\Delta_{\text{OTAREFSSENS}}$ Local Area BS: -35 - $\Delta_{\text{OTAREFSSENS}}$ (note 2)	± 30	20 MHz DFT-s- OFDM NR signal, 15 kHz SCS, 100 RBs
	EIS _{minSENS} + 6 dB (note 3 and note 5)		Wide Area BS: -43 - Δ_{minSENS} Medium Range BS: -38 - Δ_{minSENS} Local Area BS: -35 - Δ_{minSENS} (note 3)		
NOTE 1: EIS _{REFSENS} and EIS _{minSENS} depends on the BS channel bandwidth as specified in ETSI TS 138 104 [3], clauses 10.3.2 and 10.2.1.					
NOTE 2: This requirement is only applied in the OTA REFSSENS conformance test directions (D.55).					
NOTE 3: This requirement is only applied in the OTA minSENS receiver target reference direction.					
NOTE 4: For multi-band RIBs, in case of interfering signal that is not in the in-band blocking frequency range of the operating band where the wanted signal is present, and not in an adjacent or overlapping band, the wanted signal mean power shall be equal to EIS _{REFSENS} +1,4 dB.					
NOTE 5: For multi-band RIBs, in case of interfering signal that is not in the in-band blocking frequency range of the operating band where the wanted signal is present, and not in an adjacent or overlapping band, the wanted signal mean power shall be equal to EIS _{minSENS} +1,4 dB.					

Table 4.3.20.2.1-3: OTA narrowband blocking requirement for BS type 1-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	OTA Wanted signal mean power (dBm)			OTA Interfering signal mean power (dBm)
	f ≤ 3,0 GHz	3,0 GHz < f ≤ 4,2 GHz	4,2 GHz < f ≤ 6,0 GHz	
5, 10, 15, 20	EIS _{REFSENS} + 6 dB (note 3)			Wide Area BS: -49 - Δ _{OTAREFSSENS} Medium Range BS: -44 - Δ _{OTAREFSSENS} Local Area BS: -41 - Δ _{OTAREFSSENS}
	EIS _{minSENS} + 6 dB (note 4)			Wide Area BS: -49 - Δ _{minSENS} Medium Range BS: -44 - Δ _{minSENS} Local Area BS: -41 - Δ _{minSENS}
25, 30, 40, 50, 60, 70, 80, 90, 100	EIS _{REFSENS} + 6 dB (note 3)			Wide Area BS: -49 - Δ _{OTAREFSSENS} Medium Range BS: -44 - Δ _{OTAREFSSENS} Local Area BS: -41 - Δ _{OTAREFSSENS}
	EIS _{minSENS} + 6 dB (note 4)			Wide Area BS: -49 - Δ _{minSENS} Medium Range BS: -44 - Δ _{minSENS} Local Area BS: -41 - Δ _{minSENS}
NOTE 1: The SCS for the <i>lowest/highest carrier</i> received is the lowest SCS supported by the BS for that bandwidth.				
NOTE 2: EIS _{REFSENS} and EIS _{minSENS} depends on the BS <i>channel bandwidth</i> as specified in ETSI TS 138 104 [3], clauses 10.3.2 and 10.2.1.				
NOTE 3: This requirement is only applied in the OTA REFSENS conformance test directions (D.55).				
NOTE 4: This requirement is only applied in the OTA <i>minSENS</i> receiver target reference direction.				
NOTE 5: 7,5 kHz shift is not applied to the wanted signal.				

Table 4.3.20.2.1-4: OTA narrowband blocking interferer frequency offsets for BS type 1-O

<i>BS channel bandwidth of the lowest/highest carrier received (MHz)</i>	Interfering RB centre frequency offset to the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 2)	Type of interfering signal	
5	$\pm(350 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24	5 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB	
10	$\pm(355 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24		
15	$\pm(360 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24		
20	$\pm(350 + m \times 180)$, m=0, 1, 2, 3, 4, 9, 14, 19, 24		
25	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99	20 MHz DFT-s-OFDM NR signal, 15 kHz SCS, 1 RB	
30	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
40	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
50	$\pm(560 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
60	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
70	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
80	$\pm(560 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
90	$\pm(570 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
100	$\pm(565 + m \times 180)$, m=0, 1, 2, 3, 4, 29, 54, 79, 99		
NOTE 1: Interfering signal consisting of one resource block is positioned at the stated offset, the channel bandwidth of the interfering signal is located adjacently to the lower/upper <i>Base Station RF Bandwidth edge</i> .			
NOTE 2: The centre of the interfering RB refers to the frequency location between the two central subcarriers.			

4.3.20.2.2 BS type 2-O

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel.

For *BS type 2-O*, the OTA wanted and OTA interfering signals are provided at RIB using the parameters in table 4.3.20.2.2-2 for general OTA blocking requirements. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.2 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal are further specified in ETSI TS 138 104 [3], annex D.

The OTA blocking requirements are applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For *BS type 2-O* the OTA blocking requirement shall apply in the in-band blocking frequency range, which is defined within the frequency range from $F_{UL_low} - \Delta f_{OOB}$ to $F_{UL_high} + \Delta f_{OOB}$, where the Δf_{OOB} for *BS type 2-O* is defined in table 4.3.20.2.2-1.

Table 4.3.20.2.2-1: Δf_{OOB} offset for NR operating bands in FR2

BS type	Operating band characteristics	Δf_{OOB} (MHz)
BS type 2-O	$F_{UL_high} - F_{UL_low} \leq 3\,250$ MHz	1 500

For a RIBs supporting operation in a *non-contiguous spectrum* within any *operating band*, the OTA blocking requirements apply also inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as twice the interfering signal minimum offset in table 4.3.20.2.2-2. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

Table 4.3.20.2.2-2: General OTA blocking requirement for BS type 2-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	OTA wanted signal mean power (dBm)		OTA interfering signal mean power (dBm)	OTA interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of OTA interfering signal
	$24,24 \text{ GHz} < f \leq 33,4 \text{ GHz}$	$37 \text{ GHz} < f \leq 52,6 \text{ GHz}$			
50, 100, 200, 400	$EIS_{REFSENS} + 6 \text{ dB}$	$EIS_{REFSENS} + 6 \text{ dB}$	$EIS_{REFSENS_50M} + 33 + \Delta f_{FR2_REFSENS} \text{ dB}$	± 75	50 MHz DFT-s-OFDM NR signal 60 kHz SCS
NOTE: $EIS_{REFSENS}$ and $EIS_{REFSENS_50M}$ are given in ETSI TS 138 104 [3], clause 10.3.3.					

4.3.20.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.20 of the present document.

4.3.21 OTA Out-of-band blocking

4.3.21.1 Definition and applicability

The OTA out-of-band blocking characteristics are a measure of the receiver unit ability to receive a wanted signal at the *RIB* at its assigned channel in the presence of an unwanted interferer.

For the general OTA out-of-band blocking the requirement applies to the wanted signal for each supported polarization, under the assumption of *polarization match*. The interferer shall be *polarization matched* for in-band frequencies and the polarization maintained for out-of-band frequencies.

The requirement shall apply to all connectors.

4.3.21.2 Limits

4.3.21.2.1 BS type 1-O General blocking

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 4.3.21.2.1-1, the following requirements shall be met:

- The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.1.

For a *multi-band RIB*, the OTA out-of-band requirement shall apply for each supported *operating band*, with the exception that the in-band blocking frequency ranges of all supported *operating bands* according to clause 7.4.2.2 in ETSI TS 138 104 [3] shall be excluded from the OTA out-of-band blocking requirement.

For *BS type 1-O* the OTA out-of-band blocking requirement apply from 30 MHz to $F_{UL_low} - \Delta f_{OOB}$ and from $F_{UL_high} + \Delta f_{OOB}$ up to 12 750 MHz, including the downlink frequency range of the FDD *operating band* for BS supporting FDD. The Δf_{OOB} for *BS type 1-O* is defined in table 4.3.20.2.1-1.

Table 4.3.21.2.1-1: OTA out-of-band blocking requirement

Wanted signal mean power (dBm)	Interfering signal RMS field-strength (V/m)	Type of interfering signal
$EIS_{minSENS} + 6$ dB (note 1)	0,36 V/m	CW carrier
NOTE 1: $EIS_{minSENS}$ depends on the <i>BS channel bandwidth</i> as specified in ETSI TS 138 104 [3], clause 10.2.1. NOTE 2: The RMS field-strength level in V/m is related to the interferer EIRP level at a distance described as $E = \frac{\sqrt{30EIRP}}{r}$, where EIRP is in W and r is in m; for example, 0,36 V/m is equivalent to 36 dBm at fixed distance of 30 m.		

4.3.21.2.2 BS type 2-O general blocking

For OTA wanted and OTA interfering signals provided at the RIB using the parameters in table 4.3.21.2.2-1, the following requirements shall be met:

- The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.2.

For *BS type 2-O* the OTA out-of-band blocking requirement apply from 30 MHz to $F_{UL_low} - \Delta f_{OOB}$ and from $F_{UL_high} + \Delta f_{OOB}$ up to min(2nd harmonic of the upper frequency edge of the *operating band*, 60 GHz). The Δf_{OOB} for *BS type 2-O* is defined in table 4.3.20.2.2-1.

Table 4.3.21.2.2-1: OTA out-of-band blocking requirement

Frequency range of interfering signal (MHz)	Wanted signal mean power (dBm)	Interferer RMS field-strength (V/m)	Type of interfering signal
30 to 12 750	EIS _{REFSENS} + 6 dB	0,36	CW carrier
12 750 to F _{UL_low} - Δf _{OOB}		0,1	
F _{UL_high} + Δf _{OOB} to min(2 nd harmonic of the upper frequency edge of the <i>operating band</i> , 60 000)		0,1	
NOTE: EIS _{REFSENS} is given in ETSI TS 138 104 [3], clause 10.3.3.			

4.3.21.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.21 of the present document.

4.3.22 OTA Receiver intermodulation

4.3.22.1 Definition and applicability

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal.

4.3.22.2 Limits

4.3.22.2.1 BS type 1-O

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and:

- when the wanted signal is based on $EIS_{REFSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *FRI OTA REFSENS RoAoA*;
- when the wanted signal is based on $EIS_{minSENS}$: the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel, with a wanted signal at the assigned channel frequency and two interfering signals at the RIB with the conditions specified in tables 4.3.22.2.1-1 and 4.3.22.2.1-2 for intermodulation and in tables 4.3.22.2.1-3 and 4.3.22.2.1-4 for narrowband intermodulation.

The reference measurement channel for the wanted signal is identified in clause 4.3.25.2.1 for each *BS channel bandwidth* and *BS class*.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal, except for the case of wanted signal subcarrier spacing 60 kHz and *BS channel bandwidth* ≤ 20 MHz, for which the subcarrier spacing of the interfering signal should be 30 kHz.

The receiver intermodulation requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth* edges. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For a RIBs supporting operation in a *non-contiguous spectrum* within any *operating band*, the narrowband intermodulation requirement shall apply also inside any *sub-block gap* in case the *sub-block gap* is at least as wide as the bandwidth of the NR interfering signal. The interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For *multi-band RIBs*, the intermodulation requirement shall apply also inside any *Inter RF Bandwidth gap*, in case the gap size is at least twice as wide as the E-UTRA interfering signal centre frequency offset from the *Base Station RF Bandwidth edge*.

For *multi-band RIBs*, the narrowband intermodulation requirement shall apply also inside any *Inter RF Bandwidth gap* in case the gap size is at least as wide as the E-UTRA interfering signal. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 4.3.22.2.1-1: General intermodulation requirement

BS class	Wanted Signal mean power (dBm)	Mean power of interfering signals (dBm)	Type of interfering signal
Wide Area BS	$EIS_{REFSENS} + 6 \text{ dB}$	$-52 - \Delta_{OTAREFSSENS}$	See table 4.3.22.2.1-2
	$EIS_{minSENS} + 6 \text{ dB}$	$-52 - \Delta_{minSENS}$	
Medium Range BS	$EIS_{REFSENS} + 6 \text{ dB}$	$-47 - \Delta_{OTAREFSSENS}$	
	$EIS_{minSENS} + 6 \text{ dB}$	$-47 - \Delta_{minSENS}$	
Local Area BS	$EIS_{REFSENS} + 6 \text{ dB}$	$-44 - \Delta_{OTAREFSSENS}$	
	$EIS_{minSENS} + 6 \text{ dB}$	$-44 - \Delta_{minSENS}$	
NOTE: $EIS_{REFSENS}$ and $EIS_{minSENS}$ depend on the BS class and on the BS channel bandwidth as specified in ETSI TS 138 104 [3], clauses 10.3.2 and 10.2.1.			

Table 4.3.22.2.1-2: Interfering signals for intermodulation requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the lower/upper base station RF Bandwidth edge (MHz)	Type of interfering signal (note 3)
5	$\pm 7,5$	CW
	$\pm 17,5$	5 MHz DFT-s-OFDM NR signal (note 1)
10	$\pm 7,465$	CW
	$\pm 17,5$	5 MHz DFT-s-OFDM NR signal (note 1)
15	$\pm 7,43$	CW
	$\pm 17,5$	5 MHz DFT-s-OFDM NR signal (note 1)
20	$\pm 7,395$	CW
	$\pm 17,5$	5 MHz DFT-s-OFDM NR signal (note 1)
25	$\pm 7,465$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
30	$\pm 7,43$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
40	$\pm 7,45$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
50	$\pm 7,35$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
60	$\pm 7,49$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
70	$\pm 7,42$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
80	$\pm 7,44$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
90	$\pm 7,46$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
100	$\pm 7,48$	CW
	± 25	20 MHz DFT-s-OFDM NR signal (note 2)
NOTE 1: For the 15 kHz subcarrier spacing, the number of RB is 25. For the 30 kHz subcarrier spacing, the number of RB is 10.		
NOTE 2: For the 15 kHz subcarrier spacing, the number of RB is 100. For the 30 kHz subcarrier spacing, the number of RB is 50. For the 60 kHz subcarrier spacing, the number of RB is 24.		
NOTE 3: The RBs shall be placed adjacent to the <i>transmission bandwidth</i> configuration edge which is closer to the <i>Base Station RF Bandwidth</i> edge.		

Table 4.3.22.2.1-3: Narrowband intermodulation requirement in FR1

BS class	Wanted signal mean power (dBm)	Interfering signal mean power (dBm)	Type of interfering signal
Wide Area BS	$EIS_{REFSENS} + 6 \text{ dB}$ (note)	$-52 - \Delta_{OTAREFSENS}$	See table 4.3.22.2.1-4
	$EIS_{minSENS} + 6 \text{ dB}$ (note)	$-52 - \Delta_{minSENS}$	
Medium Range BS	$EIS_{REFSENS} + 6 \text{ dB}$ (note)	$-47 - \Delta_{OTAREFSENS}$	
	$EIS_{minSENS} + 6 \text{ dB}$ (note)	$-47 - \Delta_{minSENS}$	
Local Area BS	$EIS_{REFSENS} + 6 \text{ dB}$ (note)	$-44 - \Delta_{OTAREFSENS}$	
	$EIS_{minSENS} + 6 \text{ dB}$ (note)	$-44 - \Delta_{minSENS}$	
NOTE: $EIS_{REFSENS}$ and $EIS_{minSENS}$ depends on the BS channel bandwidth as specified in ETSI TS 138 104 [3], clauses 10.3.2 and 10.2.1.			

Table 4.3.22.2.1-4: Interfering signals for narrowband intermodulation requirement in FR1

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 3)	Type of interfering signal
5	± 360	CW
	$\pm 1\,420$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
10	± 370	CW
	$\pm 1\,960$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
15 (note 2)	± 380	CW
	$\pm 1\,960$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
20 (note 2)	± 390	CW
	$\pm 2\,320$	5 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
25 (note 2)	± 325	CW
	$\pm 2\,350$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
30 (note 2)	± 335	CW
	$\pm 2\,350$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
40 (note 2)	± 355	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
50 (note 2)	± 375	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
60 (note 2)	± 395	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
70 (note 2)	± 415	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
80 (note 2)	± 435	CW
	$\pm 2\,710$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
90 (note 2)	± 365	CW
	$\pm 2\,530$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)
100 (note 2)	± 385	CW
	$\pm 2\,530$	20 MHz DFT-s-OFDM NR signal, 1 RB (note 1)

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering RB centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (kHz) (note 3)	Type of interfering signal
NOTE 1: Interfering signal consisting of one resource block positioned at the stated offset, the <i>BS channel bandwidth</i> of the interfering signal is located adjacently to the lower/upper <i>Base Station RF Bandwidth edge</i> .		
NOTE 2: This requirement shall apply only for a G-FRC mapped to the frequency range at the <i>channel edge</i> adjacent to the interfering signals.		
NOTE 3: The centre of the interfering RB refers to the frequency location between the two central subcarriers.		

4.3.22.2.2 BS type 2-O

Throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel, with OTA wanted signal at the assigned channel frequency and two OTA interfering signals provided at the RIB using the parameters in tables 4.3.22.2.2-1 and 4.3.22.2.2-2. All of the OTA test signals arrive from the same direction, and the requirement is valid if the signals arrive from any direction within the *FR2 OTA REFSENS RoAoA*. The reference measurement channel for the wanted signal is identified in clause 4.3.25.2.2 for each *BS channel bandwidth* and *BS class*.

The subcarrier spacing for the modulated interfering signal shall be the same as the subcarrier spacing for the wanted signal.

The receiver intermodulation requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth* edges. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

Table 4.3.22.2.2-1: General intermodulation requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Mean power of interfering signals (dBm)	Wanted signal mean power (dBm)	Type of interfering signals
50, 100, 200, 400	$EIS_{REFSENS_50M} + 25 + \Delta_{FR2_REFSENS}$ dB	$EIS_{REFSENS} + 6$ dB	See table 4.3.22.2.2-2
NOTE: $EIS_{REFSENS}$ and $EIS_{REFSENS_50M}$ are given in ETSI TS 138 104 [3], clause 10.3.3.			

Table 4.3.22.2.2-2: Interfering signals for intermodulation requirement

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the Base Station RF Bandwidth edge (MHz)	Type of interfering signals
50 MHz	$\pm 7,5$	CW
	± 40	50 MHz DFT-s-OFDM NR signal (note)
100 MHz	$\pm 6,88$	CW
	± 40	50 MHz DFT-s-OFDM NR signal (note)
200 MHz	$\pm 5,64$	CW
	± 40	50 MHz DFT-s-OFDM NR signal (note)
400 MHz	$\pm 6,02$	CW
	± 45	50 MHz DFT-s-OFDM NR signal (note)
NOTE: For the 60 kHz subcarrier spacing, the number of RB is 64. For the 120 kHz subcarrier spacing, the number of RB is 32.		

4.3.22.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.22 of the present document.

4.3.23 OTA Adjacent Channel Selectivity (ACS)

4.3.23.1 Definition and applicability

OTA Adjacent Channel Selectivity (ACS) is a measure of the receiver's ability to receive an OTA wanted signal at its assigned channel frequency in the presence of an OTA adjacent channel signal with a specified centre frequency offset of the interfering signal to the band edge of a victim system. The wanted and interfering signals apply to each supported polarizations, under the assumption of *polarization match*.

4.3.23.2 Limits

4.3.23.2.1 BS type 1-O

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction, and the AoA of the incident wave of a received signal and the interfering signal are within the *minSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel.

For FR1, the OTA wanted and the interfering signal are specified in table 4.3.23.2.1-1 and table 4.3.23.2.1-2 for ACS. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.1 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal is further specified in ETSI TS 138 104 [3], annex D.

The OTA ACS requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The OTA interfering signal offset is defined relative to the *Base station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA ACS requirement shall apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the NR interfering signal in table 4.3.23.2.1-2. The OTA interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

For *multi-band RIBs*, the OTA ACS requirement shall apply in addition inside any *Inter RF Bandwidth gap*, in case the *Inter RF Bandwidth gap* size is at least as wide as the NR interfering signal in table 4.3.23.2.1-2. The interfering signal offset is defined relative to the *Base Station RF Bandwidth edges* inside the *Inter RF Bandwidth gap*.

Table 4.3.23.2.1-1: OTA ACS requirement for BS type 1-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm) (note 2)			Interfering signal mean power (dBm)
	f ≤ 3,0 GHz	3,0 GHz < f ≤ 4,2 GHz	4,2 GHz < f ≤ 6,0 GHz	
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 (note 1)	EIS _{minSENS} + 6 dB			Wide Area BS: -52 - Δ _{minSENS} Medium Range BS: -47 - Δ _{minSENS} Local Area BS: -44 - Δ _{minSENS}
NOTE 1: The SCS for the <i>lowest/highest carrier</i> received is the lowest SCS supported by the BS for that bandwidth.				
NOTE 2: EIS _{minSENS} depends on the <i>BS channel bandwidth</i> as specified in ETSI TS 138 104 [3], clause 10.2.1.				

Table 4.3.23.2.1-2: OTA ACS interferer frequency offset for BS type 1-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
5	$\pm 2,5025$	5 MHz DFT-s-OFDM NR signal
10	$\pm 2,5075$	
15	$\pm 2,5125$	
20	$\pm 2,5025$	
25	$\pm 9,4675$	20 MHz DFT-s-OFDM NR signal
30	$\pm 9,4725$	

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
40	±9,4675	
50	±9,4625	
60	±9,4725	
70	±9,4675	
80	±9,4625	
90	±9,4725	
100	±9,4675	

4.3.23.2.2 BS type 2-O

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA*.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel.

For FR2, the OTA wanted and the interfering signal are specified in table 4.3.23.2.2-1 and table 4.3.23.2.2-2 for ACS. The reference measurement channel for the OTA wanted signal is identified in clause 4.3.25.2.2 for each *BS channel bandwidth* and *BS class*. The characteristics of the interfering signal is further specified in ETSI TS 138 104 [3], annex D.

The OTA ACS requirement is applicable outside the *Base Station RF Bandwidth* or *Maximum Radio Bandwidth*. The OTA interfering signal offset is defined relative to the *Base station RF Bandwidth edges* or *Maximum Radio Bandwidth edges*.

For RIBs supporting operation in *non-contiguous spectrum* within any *operating band*, the OTA ACS requirement shall apply in addition inside any *sub-block gap*, in case the *sub-block gap* size is at least as wide as the NR interfering signal in table 4.3.23.2.2-2. The OTA interfering signal offset is defined relative to the *sub-block edges* inside the *sub-block gap*.

Table 4.3.23.2.2-1: OTA ACS requirement for BS type 2-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	Wanted signal mean power (dBm)		Interfering signal mean power (dBm)
	24,24 GHz < f ≤ 33,4 GHz	37 GHz < f ≤ 52,6 GHz	
50, 100, 200, 400	EIS _{REFSENS} + 6 dB (note 3)	EIS _{REFSENS} + 6 dB (note 3)	EIS _{REFSENS_50M} + 27,7 + Δ _{FR2_REFSENS} (note 1) EIS _{REFSENS_50M} + 26,7 + Δ _{FR2_REFSENS} (note 2)
NOTE 1: Applicable to bands defined within the frequency spectrum range of 24,25 GHz to 33,4 GHz.			
NOTE 2: Applicable to bands defined within the frequency spectrum range of 37 GHz to 52,6 GHz.			
NOTE 3: EIS _{REFSENS} is specified in ETSI TS 138 104 [3], clause 10.3.3.			

Table 4.3.23.2.2-2: OTA ACS interferer frequency offset for BS type 2-O

BS channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency offset from the lower/upper Base Station RF Bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Type of interfering signal
50	±24,29	50 MHz DFT-s-OFDM NR signal 60 kHz SCS
100	±24,31	
200	±24,29	
400	±24,31	

4.3.23.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.23 of the present document.

4.3.24 OTA Sensitivity

4.3.24.1 Definition and applicability

The OTA sensitivity requirement is based upon the minimum EIS (D.27) and OSDD, which are describing the intended *BS receiver beam* performance under normal operation.

NOTE 1: $EIS_{minSENS}$ is the lowest EIS value among all OSDD's, while its related range of angles of arrival is called *minSENS RoAoA*.

NOTE 2: There is no OTA sensitivity requirement for *BS type 2-O*, as the OTA sensitivity is the same as the OTA reference sensitivity in clause 4.3.25.

The minimum EIS level shall apply to each supported polarization, under the assumption of *polarization match*.

4.3.24.2 Limits

For each carrier, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel with parameters specified in table 4.3.24.2-1.

Reference measurement channels are specified in ETSI TS 138 141-2 [2], clause A.1.

Table 4.3.24.2-1: OTA sensitivity parameters

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA sensitivity level, EIS (dBm)		
			$f \leq 3,0 \text{ GHz}$	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$4,2 \text{ GHz} < f \leq 6,0 \text{ GHz}$
5, 10, 15, 25, 30	15	G-FR1-A1-1	Minimum EIS + 1,3 dB	Minimum EIS + 1,4 dB	Minimum EIS + 1,6 dB
5, 10, 15, 25, 30	30	G-FR1-A1-2			
10, 15, 25, 30	60	G-FR1-A1-3			
20, 40, 50, 60, 70, 80, 90, 100	15	G-FR1-A1-4			
20, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5			
20, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6			
NOTE: EIS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full <i>BS channel bandwidth</i> .					

4.3.24.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.24 of the present document.

4.3.25 OTA Reference sensitivity

4.3.25.1 Definition and applicability

The OTA reference sensitivity requirement is based upon assumptions of a minimum antenna array gain over *OTA REFSENS RoAoA*, describing the intended *BS Type I-H* and *I-O* receiver performance, under normal operation.

The OTA reference sensitivity requirement is intended to ensure the minimum OTA reference sensitivity level for a certain *OTA REFSENS RoAoA*.

The OTA reference sensitivity power level $EIS_{REFSENS}$ is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel.

The OTA reference sensitivity EIS level shall apply to each supported polarization, under the assumption of *polarization match*.

4.3.25.2 Limits

4.3.25.2.1 BS type 1-O

For each carrier, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel with parameters specified in tables 4.3.25.2.1-1 to 4.3.25.2.1-3.

Reference measurement channels are specified in ETSI 138 141-2 [2], clause A.1.

Table 4.3.25.2.1-1: Wide Area BS OTA reference sensitivity parameters

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, EIS _{REFSENS} (dBm)		
			$f \leq 3,0$ GHz	$3,0$ GHz $< f \leq 4,2$ GHz	$4,2$ GHz $< f \leq 6,0$ GHz
5, 10, 15, 25, 30	15	G-FR1-A1-1	-100,4 - $\Delta_{\text{OTAREFSSENS}}$	-100,3 - $\Delta_{\text{OTAREFSSENS}}$	-100,1 - $\Delta_{\text{OTAREFSSENS}}$
5, 10, 15, 25, 30	30	G-FR1-A1-2	-100,5 - $\Delta_{\text{OTAREFSSENS}}$	-100,4 - $\Delta_{\text{OTAREFSSENS}}$	-100,2 - $\Delta_{\text{OTAREFSSENS}}$
10, 15, 25, 30	60	G-FR1-A1-3	-97,6 - $\Delta_{\text{OTAREFSSENS}}$	-97,5 - $\Delta_{\text{OTAREFSSENS}}$	-97,3 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	15	G-FR1-A1-4	-94 - $\Delta_{\text{OTAREFSSENS}}$	-93,9 - $\Delta_{\text{OTAREFSSENS}}$	-93,7 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-94,3 - $\Delta_{\text{OTAREFSSENS}}$	-94,2 - $\Delta_{\text{OTAREFSSENS}}$	-94 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-94,4 - $\Delta_{\text{OTAREFSSENS}}$	-94,3 - $\Delta_{\text{OTAREFSSENS}}$	-94,1 - $\Delta_{\text{OTAREFSSENS}}$
NOTE: EIS _{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.					

Table 4.3.25.2.1-2: Medium Range BS OTA reference sensitivity parameters

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, EIS _{REFSENS} (dBm)		
			$f \leq 3,0$ GHz	$3,0$ GHz $< f \leq 4,2$ GHz	$4,2$ GHz $< f \leq 6,0$ GHz
5, 10, 15, 25, 30	15	G-FR1-A1-1	-95,4 - $\Delta_{\text{OTAREFSSENS}}$	-95,3 - $\Delta_{\text{OTAREFSSENS}}$	-95,1 - $\Delta_{\text{OTAREFSSENS}}$
5, 10, 15, 25, 30	30	G-FR1-A1-2	-95,5 - $\Delta_{\text{OTAREFSSENS}}$	-95,4 - $\Delta_{\text{OTAREFSSENS}}$	-95,2 - $\Delta_{\text{OTAREFSSENS}}$
10, 15, 25, 30	60	G-FR1-A1-3	-92,6 - $\Delta_{\text{OTAREFSSENS}}$	-92,5 - $\Delta_{\text{OTAREFSSENS}}$	-92,3 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	15	G-FR1-A1-4	-89 - $\Delta_{\text{OTAREFSSENS}}$	-88,9 - $\Delta_{\text{OTAREFSSENS}}$	-88,7 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-89,3 - $\Delta_{\text{OTAREFSSENS}}$	-89,2 - $\Delta_{\text{OTAREFSSENS}}$	-89 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-89,4 - $\Delta_{\text{OTAREFSSENS}}$	-89,3 - $\Delta_{\text{OTAREFSSENS}}$	-89,1 - $\Delta_{\text{OTAREFSSENS}}$
NOTE: EIS _{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.					

Table 4.3.25.2.1-3: Local Area BS OTA reference sensitivity parameters

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, EIS _{REFSENS} (dBm)		
			f ≤ 3,0 GHz	3,0 GHz < f ≤ 4,2 GHz	4,2 GHz < f ≤ 6,0 GHz
5, 10, 15, 25, 30	15	G-FR1-A1-1	-92,4 - $\Delta_{\text{OTAREFSSENS}}$	-92,3 - $\Delta_{\text{OTAREFSSENS}}$	-92,1 - $\Delta_{\text{OTAREFSSENS}}$
5, 10, 15, 25, 30	30	G-FR1-A1-2	-92,5 - $\Delta_{\text{OTAREFSSENS}}$	-92,4 - $\Delta_{\text{OTAREFSSENS}}$	-92,2 - $\Delta_{\text{OTAREFSSENS}}$
10, 15, 25, 30	60	G-FR1-A1-3	-89,6 - $\Delta_{\text{OTAREFSSENS}}$	-89,5 - $\Delta_{\text{OTAREFSSENS}}$	-89,3 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	15	G-FR1-A1-4	-86 - $\Delta_{\text{OTAREFSSENS}}$	-85,9 - $\Delta_{\text{OTAREFSSENS}}$	-85,7 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	30	G-FR1-A1-5	-86,3 - $\Delta_{\text{OTAREFSSENS}}$	-86,2 - $\Delta_{\text{OTAREFSSENS}}$	-86 - $\Delta_{\text{OTAREFSSENS}}$
20, 40, 50, 60, 70, 80, 90, 100	60	G-FR1-A1-6	-86,4 - $\Delta_{\text{OTAREFSSENS}}$	-86,3 - $\Delta_{\text{OTAREFSSENS}}$	-86,1 - $\Delta_{\text{OTAREFSSENS}}$
NOTE: EIS _{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.					

4.3.25.2.2 BS type 2-O

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel when the OTA test signal is at the corresponding EIS_{REFSENS} level and arrives from any direction within the *OTA REFSENS RoAoA*.

EIS_{REFSENS} levels are derived from a single basis level EIS_{REFSENS_50M}, which is based on a reference measurement channel with 50 MHz BS channel bandwidth.

NOTE: EIS_{REFSENS_50M} itself is not a requirement and although it is based on a reference measurement channel with 50 MHz BS channel bandwidth it does not imply that BS has to support 50 MHz BS channel bandwidth.

For each BS class, the EIS_{REFSENS_50M} included in the technical documentation shall be an integer number in a specific range of values indicated in table 4.3.25.2.2-2.

Reference measurement channels are specified in ETSI 138 141-2 [2], clause A.1.

Table 4.3.25.2.2-1: FR2 OTA reference sensitivity parameters

BS channel bandwidth (MHz)	Sub-carrier spacing (kHz)	Reference measurement channel	OTA reference sensitivity level, EIS _{REFSENS} (dBm)
50, 100, 200	60	G-FR2-A1-1	EIS _{REFSENS_50M} + 2,4 + $\Delta_{\text{FR2_REFSENS}}$
50	120	G-FR2-A1-2	EIS _{REFSENS_50M} + 2,4 + $\Delta_{\text{FR2_REFSENS}}$
100, 200, 400	120	G-FR2-A1-3	EIS _{REFSENS_50M} + 3 + 2,4 + $\Delta_{\text{FR2_REFSENS}}$
NOTE 1: EIS _{REFSENS} is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full BS channel bandwidth.			
NOTE 2: EIS _{REFSENS_50M} shall be within the range specified in table 3.25.2.2-2.			

Table 4.3.25.2.2-2: Range of possible values for $EIS_{REFSENS_50M}$

$EIS_{REFSENS_50M}$	Range
Wide Area BS	-96 dbm to -119 dBm
Medium Range BS	-91 dBm to -114 dBm
Local Area BS	-86 dBm to -109 dBm

4.3.25.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.3.25 of the present document.

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.

All tests are performed using normal test environment, except where otherwise stated. For guidance on the use of other test conditions to be used in order to show compliance, reference can be made to ETSI TS 138 141-1 [1] annex B for the conducted testing and to ETSI TS 138 141-2 [2], annex B for the radiated testing.

5.2 Interpretation of measurement results

Recommended values for the maximum measurement uncertainty can be found in annex B.

5.3 Essential radio test suites

5.3.1 Introduction

This clause describes the test suites for BS.

The test configurations and channel spacing for multi-carrier operations that shall be used for demonstrating conformance are specified in clauses 4.7 and 5 in ETSI TS 138 141-1 [1] and ETSI TS 138 141-2 [2].

For the single carrier testing many tests in the present document are performed with appropriate frequencies in the bottom, middle and top of the *operating band* of the BS. These are denoted as RF channels B (bottom), M (middle) and T (top) and are defined in clause 4.9.1 in ETSI TS 138 141-1 [1] and ETSI TS 138 141-2 [2].

For single-band multi-carrier testing many tests in the present document are performed with the maximum *Base Station RF Bandwidth* position located at the bottom, middle and top of the supported frequency range in each *operating band*. These are denoted as B_{RFBW} (bottom), M_{RFBW} (middle) and T_{RFBW} (top) for non-aggregated channels and are defined in clause 4.9.1 in ETSI TS 138 141-1 [1] and ETSI TS 138 141-2 [2].

For dual-band testing many tests in the present document are performed with the *Base Station RF Bandwidths* located at bottom of the supported frequency range in the lower *operating band* and at the top of the supported frequency range in the upper *operating band*. These are denoted as $B_{\text{RFBW_T'_{RFBW}}}$ and $B'_{\text{RFBW_T_{RFBW}}}$ and are defined in clause 4.9.1 in ETSI TS 138 141-1 [1] and ETSI TS 138 141-2 [2].

5.3.2 *Operating band* unwanted emissions

5.3.2.1 General

This test verifies the emissions close to the assigned channel bandwidth of the wanted signal, while the transmitter is in operation.

5.3.2.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier:

- B_{RFBW} , M_{RFBW} and T_{RFBW} in single-band operation; see clause 5.3.1.
- $B_{\text{RFBW_T'_{RFBW}}}$ and $B'_{\text{RFBW_T_{RFBW}}}$ in multi-band operation, see clause 5.3.1.

5.3.2.3 Procedure

- 1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.1.1 for *BS type 1-C* or in ETSI TS 138 141-1 [1], clause D.3.1 for *BS type 1-H*.

The measurement device characteristics shall be: Detection mode: True RMS.

- 2) For connectors capable of single-carrier operation only, set the connectors under test to transmit at *rated carrier output power* $P_{\text{rated,c,AC}}$ for *BS type 1-C* and $P_{\text{rated,c,TABC}}$ for *BS type 1-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1 in ETSI TS 138 141-1 [1].

For a connector under test capable of multi-carrier and/or CA operation set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in ETSI TS 138 141-1 [1], clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in ETSI TS 138 141-1 [1], clause 4.9.2.

- 3) Step the centre frequency of the measurement filter in contiguous steps and measure the emission within the specified frequency ranges with the specified *measurement bandwidth*. For connector under test capable to operate in multiple bands or *non-contiguous spectrum*, the emission within the *Inter RF Bandwidth* or *sub-block gap* shall be measured using the specified *measurement bandwidth* from the closest *Base Station RF Bandwidth edge* or *sub-block edge*.
- 4) Repeat the test for the remaining test cases, with the channel set-up according to NR-FR1-TM 1.2 in ETSI TS 138 141-1 [1].

In addition, for *multi-band connectors*, the following steps shall apply:

- 5) For *multi-band connectors* and single-band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

5.3.2.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.2.2.

5.3.3 Adjacent Channel Leakage power Ratio (ACLR)

5.3.3.1 General

The test purpose is to verify the adjacent channel leakage power ratio.

5.3.3.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- B_{RFBW} , M_{RFBW} and T_{RFBW} in single-band operation; see clause 5.3.1.
- $B_{\text{RFBW_T'RFBW}}$ and $B'_{\text{RFBW_T'RFBW}}$ in multi-band operation, see clause 5.3.1.

5.3.3.3 Procedure

Connect the *single-band connector* or *multi-band connector* under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.1.1 for *BS type I-C* and in ETSI TS 138 141-1 [1], clause D.3.1 for *BS type I-H*.

The measurement device characteristics shall be:

- Measurement filter bandwidth: defined in clause 4.3.3.
- Detection mode: true RMS.

- 1) For connectors capable of single carrier operation only (D.16), set the connectors under test to transmit using the corresponding test models NR-FR1-TM1.1 in clause 4.9.2 in ETSI TS 138 141-1 [1], at *rated carrier output power* $P_{\text{rated,c,AC}}$ for *BS type I-C* and $P_{\text{rated,c,TABC}}$ for *BS type I-H* (D.21).

For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].

- 2) Measure ACLR for the frequency offsets on both sides of channel frequency. In multiple carrier case only offset frequencies below the lowest and above the highest carrier frequency used shall be measured.
- 3) For the ACLR requirement applied inside *sub-block gap* for *non-contiguous spectrum* operation, or inside *Inter RF Bandwidth gap* for multi-band operation:
 - a) Measure ACLR inside *sub-block gap* or *Inter RF Bandwidth gap* as specified in clause 4.3.3.2.3, if applicable.
 - b) Measure CACLR inside *sub-block gap* or *Inter RF Bandwidth gap* as specified in clause 4.3.3.2.3, if applicable.
- 4) Repeat the test with the channel set-up according to NR-FR1-TM 1.2 in clause 4.9.2 in ETSI TS 138 141-1 [1].

In addition, for *multi-band connectors*, the following steps shall apply:

- 5) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

5.3.3.4 Test requirement

The results shall fulfil the conditions and limits of clause 4.3.3.2.

5.3.4 Transmitter spurious emissions

5.3.4.1 General

This test verifies conducted spurious emissions while the transmitter is in operation.

5.3.4.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for single carrier:

- B when testing the spurious emissions below $F_{DL_low} - \Delta f_{OBUE}$,
- T when testing the spurious emissions above $F_{DL_high} + \Delta f_{OBUE}$; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- B_{RFBW} when testing the spurious frequencies below $F_{DL_low} - \Delta f_{OBUE}$; T_{RFBW} when testing the spurious frequencies above $F_{DL_high} + \Delta f_{OBUE}$ in single-band operation; see clause 5.3.1.
- $B_{RFBW_T_{RFBW}}$ when testing the spurious frequencies below $F_{DL_low} - \Delta f_{OBUE}$ of the lowest *operating band*; $B'_{RFBW_T_{RFBW}}$ when testing the spurious frequencies above $F_{DL_high} + \Delta f_{OBUE}$ of the highest *operating band* in multi-band operation, see clause 5.3.1.

5.3.4.3 Procedure

- 1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1] clause D.1.1 for *BS type I-C* and in clause D.3.1 for *BS type I-H*.

- 2) Measurements shall use a *measurement bandwidth* in accordance to the conditions in clause 4.3.4.2.

The measurement device characteristics shall be:

- Detection mode:
 - True RMS.

- 3) For connectors capable of single-carrier operation only (D.16), set the connectors under test to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-1 [1] at *rated carrier output power* ($P_{rated,c,AC}$, or $P_{rated,c,TABC}$, D.21). Channel set-up shall be according to NR-FR1-TM 1.1 specified in clause 4.9.1 in ETSI TS 138 141-1 [1].

For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].

- 4) Measure the emission at the specified frequencies with specified *measurement bandwidth*.

In addition, for *multi-band connectors*, the following steps shall apply:

- 5) For *multi-band connectors* and single-band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

5.3.4.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.4.2.

5.3.5 Base Station output power

5.3.5.1 General

The test purpose is to verify the accuracy of the *maximum carrier output power* across the frequency range and under normal and extreme test environment.

5.3.5.2 Initial conditions

Test environment:

- Normal, see ETSI TS 138 141-1 [1], clause B.2;
- Extreme, ETSI TS 138 141-1 [1], see clauses B.3 and B.5.

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- B_{RFBW} , M_{RFBW} and T_{RFBW} for *single-band connector(s)*, see clause 5.3.1;
- $B_{\text{RFBW_T'_{RFBW}}}$ and $B'_{\text{RFBW_T'_{RFBW}}}$ for *multi-band connector(s)*, see clause 5.3.1.

Under extreme test environment, it is sufficient to test on one NR-ARFCN or one *Base Station RF bandwidth* position, and with one applicable test configuration defined in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1]. Testing shall be performed under extreme power supply conditions, as defined in clause B.5 in ETSI TS 138 141-1 [1].

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

5.3.5.3 Procedure

- 1) Connect the power measuring equipment to *single-band connector(s)* or to *multi-band connector(s)* under test.

NOTE: Example of measurement test setup is in clause D.1.1 of ETSI TS 138 141-1 [1] for *BS type I-C* for in ETSI TS 138 141-1 [1] clause D.3.1 for *BS type I-H*.

- 2) For a single carrier, set the connector under test to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1] at *rated carrier output power* $P_{\text{rated,c,AC}}$ for *BS type I-C* and $P_{\text{rated,c,TABC}}$ for *BS type I-H* (D.21).

For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].

- 3) Measure the *maximum carrier output power* ($P_{\text{max,c,AC}}$ for *BS type I-C* and $P_{\text{max,c,TABC}}$ for *BS type I-H*) for each carrier at each connector under test.

In addition, for *multi-band connectors*, the following steps shall apply:

- 4) For *multi-band connectors* and single-band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

5.3.5.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.5.2.

5.3.6 Transmit intermodulation

5.3.6.1 General

The test purpose is to verify the ability of the transmitter units associated with the *single-band connectors* or *multi-band connector* under test to restrict the generation of intermodulation products in its nonlinear elements caused by the presence of the wanted signal and an interfering signal reaching the transmitter via the antenna to below-specified levels.

5.3.6.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- M_{RFBW} in single-band operation; see clause 5.3.1;
- $B_{\text{RFBW_T_RFBW}}$ and $B'_{\text{RFBW_T_RFBW}}$ in multi-band operation, see clause 5.3.1.

When testing in M (or MRFBW), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or BRFBW) and T (or TRFBW), and only with the interferer located inside the supported frequency range.

5.3.6.3 Procedure

5.3.6.3.1 Procedure for co-location requirement

- 1) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment.

NOTE 1: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.1.2 for *BS type I-C* and in ETSI TS 138 141-1 [1] clause D.3.2 for *BS type I-H*.

- 2) The measurement device characteristics shall be:

- Detection mode:
 - True RMS.

- 3) For a connectors capable of single carrier operation only (D.16), set the connectors under test to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-1 [1] at *rated carrier output power* $P_{\text{rated,c,AC}}$ for *BS type I-C* and $P_{\text{rated,c,TABC}}$ for *BS type I-H* (D.21). Channel set-up shall be according to NR-FR1-TM 1.1 in ETSI TS 138 141-1 [1], clause 4.9.2.

For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].

- 4) Generate the interfering signal according to NR-FR1-TM 1.1, as defined in clause 4.9.2 in ETSI TS 138 141-1 [1], with the supported minimum *BS channel bandwidth* (BW_{Channel}) with 15 kHz SCS of the band defined in clause 5.3.5 of ETSI TS 138 104 [3] and a centre frequency offset from the lower/upper edge of the wanted signal or edge of *sub-block* inside a *sub-block gap* $f_{\text{offset}} = \pm BW_{\text{Channel}} \left(n - \frac{1}{2} \right)$, for $n = 1, 2$ and 3 , but exclude interfering frequencies that are outside of the allocated *downlink operating band* or interfering frequencies that are not completely within the *sub-block gap* or within the *Inter RF Bandwidth gap*.
- 5) Adjust so that level of the interfering signal is as defined in clause 4.3.6.2 (e.g. by means of an attenuator).
- 6) Perform the unwanted emission tests specified in clauses 5.3.2 (OBUE) and 5.3.3 (ACLR) for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 4.3.2 and 4.3.3. The width of the intermodulation products shall be taken into account.
- 7) Perform the transmitter spurious emissions test as specified in clause 5.3.4, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 4.3.4. The width of the intermodulation products shall be taken into account.
- 8) Repeat the test for the remaining interfering signal centre frequency offsets according to step 4.

In addition, for *multi-band connectors*, the following steps shall apply:

- 9) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

NOTE 2: The third order intermodulation products are centred at $2F1 \pm F2$ and $2F2 \pm F1$. The fifth order intermodulation products are centred at $3F1 \pm 2F2$, $3F2 \pm 2F1$, $4F1 \pm F2$, and $4F2 \pm F1$ where $F1$ represents the test signal centre frequency or centre frequency of each *sub-block* and $F2$ represents the interfering signal centre frequency. The widths of intermodulation products are:

- $(n \times BW_{F1} + m \times BW_{F2})$ for the $nF1 \pm mF2$ products;
- $(n \times BW_{F2} + m \times BW_{F1})$ for the $nF2 \pm mF1$ products;

where BW_{F1} represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or *sub-block* bandwidth and BW_{F2} represents the interfering signal channel bandwidth.

5.3.6.3.2 Procedure for intra-system requirement

- 1) Necessary interfering signal power level at each *TAB connector* is determined as the sum of the co-channel leakage power coupled via the composite antenna connected to the transceiver unit array from all the other *TAB connectors*, without including power radiated from the Antenna Array and reflected back from the environment.
- 2) Connect the *single-band connector* or *multi-band connector* under test to measurement equipment.

NOTE: Example of measurement test setup is in clause D.3.2 in ETSI TS 138 141-1 [1] for *BS type 1-H*.

All connectors not under test shall be terminated.

- 3) The measurement device characteristics shall be:
 - Detection mode:
 - True RMS.

- 4) For the connectors capable of single carrier operation only (D.16), set the connectors under test to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-1 [1] at *rated carrier output power* $P_{\text{rated,c,TABC}}$ (D.21). Channel set-up shall be according to NR-FR1-TM 1.1 in ETSI TS 138 141-1 [1], clause 4.9.2.

For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].

- 5) Generate the interfering signal with the same configuration as the wanted signal.
- 6) Adjust so that level of the interfering signal is equal to the level determined in step 1 (e.g. by means of an attenuator).
- 7) Perform the unwanted emission measurements specified in clauses 5.3.2 (OBUE) and 5.3.3 (ACLR).

In addition, for *multi-band connectors*, the following steps shall apply:

- 8) For a *multi-band connectors* and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carrier activated in the other *operating band*.

5.3.6.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.6.2.

5.3.7 Receiver spurious emissions

5.3.7.1 General

The test purpose is to verify the ability of the BS to limit the interference caused by receiver spurious emissions to other systems.

5.3.7.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier:

- M_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW_T'RFBW}}$ and $B'_{\text{RFBW_T'RFBW}}$ in multi-band operation, see clause 5.3.1.

5.3.7.3 Procedure

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.6 for *BS type I-C* and in clause D.4.4 in ETSI TS 138 141-1 [1] for *BS type I-H*.

- 2) For FDD operation, for separate RX only connectors with single carrier operation set the connector under test to transmit at *rated carrier output power* ($P_{\text{Rated,c,AC}}$ or $P_{\text{Rated,c,TABC}}$, D.21). Channel set-up shall be according to NR-FR1-TM 1.1 as defined in ETSI TS 138 141-1 [1] clause 4.9.2.

For FDD operation, for separate RX only connectors capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9 in ETSI TS 138 141-1 [1].

For TDD connectors capable of transmit and receive ensure the transmitter is off.

- 3) Set the measurement equipment parameters as specified in table 4.3.7.2-1.
- 4) Measure the spurious emissions over each frequency range described in table 4.3.7.2-1.

In addition, for a multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H*, the following steps shall apply:

- 5) For multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.7.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.7.2.

5.3.8 In-band blocking

5.3.8.1 General

The test purpose is to verify the ability of the *BS receiver* to withstand high-levels of in-band interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

5.3.8.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for Single Carrier (SC):

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for Multi-Carrier (MC) and/or CA:

- M_{RFBW} for *single-band connector(s)*, see clause 5.3.1;
- $B_{\text{RFBW_T_RFBW}}$ and $B'_{\text{RFBW_T_RFBW}}$ for *multi-band connector(s)*, see clause 5.3.1.

When testing in M (or M_{RFBW}), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or B_{RFBW}) and T (or T_{RFBW}), and only with the interferer located inside the supported frequency range.

5.3.8.3 Procedure

5.3.8.3.1 Procedure for general blocking

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.3 for *BS type I-C* and in clause D.4.3 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit:
 - For single carrier operation set the connector under test to transmit at *rated carrier output power* ($P_{\text{rated,c,AC}}$ or $P_{\text{rated,c,TABC}}$, D.21).

- For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].
- 3) Set the signal generator for the wanted signal to transmit as specified in table 4.3.8.2-2.
 - 4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 4.3.8.2-2. The interfering signal shall be swept with a step size of 1 MHz starting from the minimum offset to the *channel edges* of the wanted signals as specified in table 4.3.8.2-2.
 - 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a *multi-band connector*, the following steps shall apply:

- 6) For *multi-band connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.8.3.2 Procedure for narrowband blocking

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.3 for *BS type I-C* and in ETSI TS 138 141-1 [1], clause D.4.3 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit:
 - For single carrier operation set the connector under test to transmit *rated carrier output power* ($P_{\text{rated,c,AC}}$ or $P_{\text{rated,c,TABC}}$, D.21).
 - For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].
- 3) Set the signal generator for the wanted signal to transmit as specified in table 4.3.8.2-3.
- 4) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in tables 4.3.8.2-3 and 4.3.8.2-4. Set-up and sweep the interfering RB centre frequency offset to the *channel edge* of the wanted signal according to table 4.3.8.2-4.
- 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a *multi-band connector*, the following steps shall apply:

- 6) For *multi-band connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other.

5.3.8.4 Requirement

The results shall fulfil the conditions and limits of clause 4.3.8.2.

5.3.9 Out-of-band blocking

5.3.9.1 General

The test purpose is to verify the out-of-band receiver blocking for *BS type I-C* and each *BS type I-H TAB connector*.

5.3.9.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for Single Carrier (SC):

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier (MC):

- M_{RFBW} for *single-band connector(s)*, see clause 5.3.1;
- $B_{\text{RFBW_T'RFBW}}$ and $B'_{\text{RFBW_T'RFBW}}$ for *multi-band TAB connector(s)*, see clause 5.3.1.

In addition, for a *multi-band connector*:

- For $B_{\text{RFBW_T'RFBW}}$, out-of-band blocking testing above the highest *operating band* may be omitted.
- For $B'_{\text{RFBW_T'RFBW}}$, out-of-band blocking testing below the lowest *operating band* may be omitted.

5.3.9.3 Procedure

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.5 for *BS type I-C* and in ETSI TS 138 141-1 [1], clause D.4.3 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit a signal according to NR-FR1-TM 1.1 in clause 4.9.2 in ETSI TS 138 141-1 [1], connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 in ETSI TS 138 141-1 [1].

The transmitter may be turned off for the out-of-band blocker tests when the frequency of the blocker is such that no IM2 or IM3 products fall inside the bandwidth of the wanted signal.

- 3) Set the signal generator for the wanted signal as defined in clause 4.3.9 to transmit as specified in table 4.3.9.2-1.
- 4) Set the Signal generator for the interfering signal to transmit at the frequency offset and as specified in table 4.3.9.2-1. The CW interfering signal shall be swept with a step size of 1 MHz over than range 1 MHz to $(F_{\text{UL_low}} - \Delta f_{\text{OOB}})$ MHz and $(F_{\text{UL_high}} + \Delta f_{\text{OOB}})$ MHz to 12 750 MHz.
- 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a *multi-band connector*, the following steps shall apply:

- 6) For *multi-band connector* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.9.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.9.2.

5.3.10 Receiver intermodulation

5.3.10.1 General

The test purpose is to verify the ability of the receiver unit associated with the *antenna connector* or *TAB connector* under test to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high-level interfering signals.

5.3.10.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for Single Carrier (SC):

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier (MC) and/or CA:

- M_{RFBW} for *single-band TAB connector(s)*, see clause 5.3.1;
- $B_{\text{RFBW_T_RFBW}}$ and $B'_{\text{RFBW_T_RFBW}}$ for *multi-band TAB connector(s)*, see clause 5.3.1.

When testing in M (or M_{RFBW}), if the interferer is fully or partially located outside the supported frequency range, then the test shall be done instead in B (or B_{RFBW}) and T (or T_{RFBW}), and only with the interferer located inside the supported frequency range.

5.3.10.3 Procedure

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.7 for *BS type I-C* and in ETSI TS 138 141-1 [1], clause D.4.6 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit:
 - For single carrier operation set the connector under test to transmit at *rated carrier output power* ($P_{\text{rated,c,AC}}$ or $P_{\text{rated,c,TABC}}$, D.21).
 - For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].
- 3) Set the signal generator for the wanted signal to transmit as specified in tables 4.3.10.2-1 and 4.3.10.2-3.
- 4) Set the signal generator(s) for the interfering signals to transmit at the frequency offset and as specified in tables 4.3.10.2-2 and 4.3.10.2-4.
- 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H*, the following steps shall apply:

- 6) For multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.10.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.10.2.

5.3.11 Adjacent Channel Selectivity (ACS)

5.3.11.1 General

The test purpose is to verify the ability of the *BS receiver* filter to suppress interfering signals in the channels adjacent to the wanted channel.

5.3.11.2 Initial conditions

Test environment:

- Normal; see in ETSI TS 138 141-1 [1], clause B.2.

RF channels to be tested for Single Carrier (SC):

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for Multi-Carrier (MC):

- M_{RFBW} for *single-band TAB connector(s)*, see clause 5.3.1;
- $B_{\text{RFBW_T}}'_{\text{RFBW}}$ and $B'_{\text{RFBW_T}}_{\text{RFBW}}$ for *multi-band TAB connector(s)*, see clause 5.3.1.

5.3.11.3 Procedure

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in ETSI TS 138 141-1 [1], clause D.2.3 for *BS type I-C* and in ETSI TS 138 141-1 [1] clause D.4.3 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit:
 - For single carrier operation set the connector under test to transmit at *rated carrier output power* ($P_{\text{rated,c,AC}}$ or $P_{\text{rated,c,TABC}}$, D.21).
 - For a connector under test capable of multi-carrier and/or CA operation (D.15-D.16) set the connector under test to transmit on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7 in ETSI TS 138 141-1 [1] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-1 [1].
- 3) Set the signal generator for the wanted signal to transmit as specified in table 4.3.10.2-1.
- 4) Set the signal generator for the interfering signal to transmit at the frequency offset as specified in tables 4.3.11.2-1 and 4.3.11.2-2.
- 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H*, the following steps shall apply:

- 6) For multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.11.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.11.2.

5.3.12 Reference sensitivity level

5.3.12.1 General

Test purpose is to verify that for the *BS type I-C* receiver and each *BS type I-H TAB connector* the throughput requirement is met at P_{REFSENS} .

5.3.12.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-1 [1], clause B.2;
- Extreme, see ETSI TS 138 141-1 [1], clauses B.3 and B5.

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Under extreme test environment the test shall be performed on each of B, M and T under extreme power supply conditions as defined in ETSI TS 138 141-1 [1], clause B.5.

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

5.3.12.3 Procedure

- 1) Connect the connector under test to measurement equipment.

NOTE: Example of measurement test setup is in clause D.2.1 in ETSI TS 138 141-1 [1] for *BS type I-C* and in ETSI TS 138 141-1 [1], clause D.4.1 for *BS type I-H*.

- 2) For FDD operation, set the BS to transmit a signal according to clause 4.9.2 in ETSI TS 138 141-1 [1], for *BS type I-C* set the *antenna connector* to the *rated carrier output power* ($P_{\text{rated,c,AC}}$ or $P_{\text{rated,c,TABC}}$, D.21).
- 3) Start the signal generator for the wanted signal to transmit the Fixed Reference Channels for reference sensitivity according to clause A.1 in ETSI TS 138 141-1 [1].
- 4) Set the signal generator for the wanted signal power as specified in clause 4.3.12.2.
- 5) Measure the throughput according to clause A.1 in ETSI TS 138 141-1 [1].

In addition, for a multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H*, the following steps shall apply:

- 6) For multi-band capable *BS type I-C* or a *multi-band TAB connector* from a *BS type I-H* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.12.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.12.2.

5.3.13 OTA operating band unwanted emissions

5.3.13.1 General

The test purpose is to measure the emissions of the BS, close to the assigned channel bandwidth of the wanted signal, while the BS is in operation.

5.3.13.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for Single Carrier (SC):

- B, M and T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for Multi-Carrier (MC) and/or CA:

- B_{RFBW} , M_{RFBW} and T_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW_T}}'$ and $B'_{\text{RFBW_T}}$ in multi-band operation, see clause 5.3.1.

Directions to be tested:

- As the requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.13.3 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 4, 6 and 9. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) The measurement devices characteristics shall be:
 - measurement filter bandwidth: defined in clauses 4.3.13.2 and 4.3.13.3;
 - detection mode: true RMS.
- 4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2] at *rated carrier output power* ($P_{\text{rated,c,TRP}}$).

For a BS capable of multi-carrier and/or CA operation, use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2] on all carriers configured.
- 5) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 6) Sweep the centre frequency of the measurement filter in contiguous steps and measure emission power within the specified frequency ranges with the specified *measurement bandwidth*.
- 7) Repeat step 5-6 for all directions in the appropriate TRP measurement grid needed for $\text{TRP}_{\text{Estimate}}$ (see annex I in ETSI TS 138 141-2 [2]).
- 8) Calculate $\text{TRP}_{\text{Estimate}}$ using the measurements made in step 6.
- 9) For *BS type 1-O* and *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.13.4 Test Requirement

The results shall fulfil the conditions and limits of clauses 4.3.13.2 and 4.3.13.3.

5.3.14 OTA Adjacent Channel Leakage power Ratio (ACLR)

5.3.14.1 General

The purpose of this test is to verify that the adjacent channel leakage power ratio is above a specified limit.

5.3.14.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for Single Carrier (SC):

- B and T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for Multi-Carrier (MC) and/or CA:

- B_{RFBW} and T_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW}}_T'_{\text{RFBW}}$ and $B'_{\text{RFBW}}_T_{\text{RFBW}}$ in multi-band operation, see clause 5.3.1.

Directions to be tested:

- As the requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.14.3 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 4, 6, 9, 10, 11, 12 and 13. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) The measurement devices characteristics shall be:
 - measurement filter bandwidth: defined in clause 4.3.14
 - detection mode: true RMS
- 4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2] at *rated carrier output power* ($P_{\text{rated,c,TRP}}$).

For a BS capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2] on all carriers configured.

- 5) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 6) Measure the absolute power of the assigned channel frequency and the (adjacent channel frequency).
- 7) Repeat step 5-6 for all directions in the appropriate TRP measurement grid needed for $\text{TRP}_{\text{Estimate}}$ (see annex I in ETSI TS 138 141-2 [2]).
- 8) Calculate $\text{TRP}_{\text{Estimate}}$ for the absolute *total radiated power* of the wanted channel and the adjacent channel using the measurements made in Step 7.
- 9) Calculate relative ACLR estimate.

NOTE: ACLR is calculated by the ratio of the absolute TRP of the assigned channel frequency and the absolute TRP of the adjacent frequency channel.

- 10) Measure OTA ACLR for the frequency offsets both side of channel frequency. In multiple carrier case only offset frequencies below the lowest and above the highest carrier frequency used shall be measured.
- 11) For the OTA ACLR requirement applied inside *sub-block gap* for *non-contiguous spectrum* operation or inside *Inter RF Bandwidth gap* for multi-band operation:
 - a) Measure OTA ACLR inside *sub-block gap* or *Inter RF Bandwidth gap*, if applicable.
 - b) Measure OTA CACLR inside *sub-block gap* or *Inter RF Bandwidth gap*, if applicable.
- 12) Repeat the test with the channel set-up using NR- FR1-TM1.2 defined in clause 4.9.2 in ETSI TS 138 141-1 [1] for *BS type I-O*.

In addition, for *multi-band RIB*, the following steps shall apply:

- 13) For *BS type I-O* and *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.14.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.14.2.

5.3.15 OTA transmitter spurious emissions

5.3.15.1 General spurious emissions

5.3.15.1.1 General

The test purpose is to verify if the radiated spurious emissions levels from the BS at the RIB are within the specified limits.

5.3.15.1.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier, see clause 5.3.1:

- For FR1:
 - B when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
- For FR2:
 - B when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 60 GHz (or to 2nd harmonic)

Base Station RF bandwidth positions to be tested in single-band multi-carrier operation, see clause 5.3.1:

- For FR1:
 - B_{RFBW} when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T_{RFBW} when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or 5th harmonic)
- For FR2:
 - B_{RFBW} when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T_{RFBW} when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 60 GHz (or to 2nd harmonic)

Base Station RF bandwidth positions to be tested in multi-band multi-carrier operation, see clause 5.3.1:

- For FR1:
 - $B_{RFBW_T'_{RFBW}}$ when testing from 30 MHz to $F_{DL_Blow_low} - \Delta f_{OBUE}$
 - $B'_{RFBW_T_{RFBW}}$ when testing from $F_{DL_Bhigh_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
 - $B_{RFBW_T'_{RFBW}}$ and $B'_{RFBW_T_{RFBW}}$ when testing from $F_{DL_Blow_high} + \Delta f_{OBUE}$ to $F_{DL_Bhigh_low} - \Delta f_{OBUE}$

Directions to be tested:

- As the requirements are expressed as TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.15.1.3 Procedure

5.3.15.1.3.1 General procedure

The general procedure steps apply to the procedures for both TRP and EIRP measurements:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Measurements shall use a *measurement bandwidth* in accordance to the conditions in clauses 4.3.15.2.1 and 4.3.15.2.2.
- 4) The measurement device characteristics shall be:
 - Detection mode: True RMS.
- 5) Set the BS to transmit:
 - For RIB capable of single carrier operation only, set the RIB to transmit a signal according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model in clause 4.9.2 in ETSI TS 138 141-2 [2] (NR-FR1-TM1.1 for *BS type 1-O* and NR-FR2-TM1.1 for *BS type 2-O*), at rated output power $P_{\text{rated,c,TRP}}$.
 - For a RIB capable of multi-carrier and/or CA operation, set the set the RIB to transmit according to the corresponding test model in clause 4.9.2 in ETSI TS 138 141-2 [2] on all carriers configured using the applicable test configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 in ETSI TS 138 141-2 [2].

5.3.15.1.3.2 Procedure for TRP measurements

The following procedure for measuring TRP is based on directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 4, 5 in clause 5.3.15.1.3.1 and steps 2 and 5 below. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 2) Measure the emission at the specified frequencies with specified *measurement bandwidth*.
- 3) Repeat step 1-2 for all directions in the appropriate TRP measurement grid needed for full TRP estimation (see annex I in ETSI TS 138 141-2 [2]).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order.

- 4) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

- 5) For *BS type 1-O* and *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.15.1.3.3 Procedure for EIRP measurement

- 1) Identify the direction of maximum EIRP of spurious emissions, at the specified frequencies with specified *measurement bandwidth*.
- 2) Measure EIRP_{p1} and EIRP_{p2} for any two orthogonal polarizations (denoted $p1$ and $p2$) and calculate:

$$\text{EIRP} = \text{EIRP}_{p1} + \text{EIRP}_{p2}$$

In addition, for *multi-band RIB(s)*, the following steps shall apply:

- 3) For *BS type 1-O* and *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.15.1.4 Test Requirement

The results shall fulfil the conditions and limits of clauses 4.3.15.2.1, 4.3.15.2.2 and 4.3.15.2.5.

5.3.15.2 Protection of *BS receiver*

5.3.15.2.1 General

The test purpose is to verify if the radiated spurious emissions levels from the BS at the RIB are within the specified limits for protection of own or a different BS of the same band.

5.3.15.2.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier:

- M_{RFBW} in *single-band RIB*, see clause 5.3.1.
- $B_{\text{RFBW}} _ T_{\text{RFBW}}$ and $B'_{\text{RFBW}} _ T_{\text{RFBW}}$ in *multi-band RIB*, see clause 5.3.1.

In addition, for *multi-band RIB*:

- For $B_{\text{RFBW}} _ T_{\text{RFBW}}$, emission testing above the highest *operating band* may be omitted.
- For $B'_{\text{RFBW}} _ T_{\text{RFBW}}$, emission testing below the lowest *operating band* may be omitted.

Directions to be tested:

- The requirement is specified as co-location requirement. For general description of co-location requirements, refer to clause 4.12 in ETSI TS 138 141-2 [2].

The co-location spurious emission is measured at the CLTA conducted output(s).

5.3.15.2.3 Procedure

- 1) Select and place the BS and CLTA as described in clause 4.12 in ETSI TS 138 141-2 [2] with parameters as specified in table 4.12.2.2-1 and table 4.12.2.3-1 in ETSI TS 138 141-2 [2].
- 2) Several CLTAs might be required to cover the whole co-location spurious emission frequency ranges.
- 3) Place test antenna in reference direction at far-field distance, aligned in all supported polarizations (single or dual) with the BS as depicted in clause E.1.3 in ETSI TS 138 141-2 [2].
- 4) The test antenna shall be dual (or single) polarized with the same frequency range as the BS for co-location spurious emission test case.
- 5) Connect test antenna and CLTA to the measurement equipment as depicted in clause E.1.3 in ETSI TS 138 141-2 [2].
- 6) OTA co-location spurious emission is measured as the sum of powers over all supported polarizations at the CLTA conducted output(s).

- 7) The measurement device (signal analyser) characteristics shall be:
- 8) Detection mode: True RMS.
- 9) Set the *BS type I-O* to transmit:
 - Set the BS to transmit maximum power according to the applicable test configuration in clause 4.7 in ETSI TS 138 141-2 [2] using the corresponding test models or set of physical channels in clause 4.9.2 in ETSI TS 138 141-2 [2].
- 10) Measure the emission at the specified frequencies with specified *measurement bandwidth*.

In addition, for *multi-band RIB*, the following steps shall apply:

- 11) For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.15.2.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.15.2.3.

5.3.15.3 Co-existence with other systems

5.3.15.3.1 General

5.3.15.3.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- For FR1:
 - B when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)

Base Station RF bandwidth positions to be tested in single-band multi-carrier operation:

- For FR1:
 - B_{RFBW} when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T_{RFBW} when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)

Base Station RF bandwidth positions to be tested in multi-band multi-carrier operation:

- For FR1:
 - $B_{RFBW_T'RFBW}$ when testing from 30 MHz to $F_{DL_Blow_low} - \Delta f_{OBUE}$
 - $B'RFBW_T_{RFBW}$ when testing from $F_{DL_Bhigh_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
 - $B_{RFBW_T'RFBW}$ and $B'RFBW_T_{RFBW}$ when testing from $F_{DL_Blow_high} + \Delta f_{OBUE}$ to $F_{DL_Bhigh_low} - \Delta f_{OBUE}$

Directions to be tested:

- As the FR1 requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.15.3.3 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 4, 5, 7 and 10. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Measurements shall use a *measurement bandwidth* in accordance to the conditions in clause 4.3.15.2.4.
- 4) The measurement device characteristics shall be:
 - Detection mode: True RMS.
- 5) Set the BS to transmit:
 - For RIB capable of single carrier operation only, set the RIB to transmit a signal according to E-TM1.1 in clause 4.9.2 in ETSI TS 138 141-2 [2], at rated output power $P_{\text{rated,c,TRP}}$.
 - For a RIB capable of multi-carrier and/or CA operation, set the set the RIB to transmit according to E-TM1.1 on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7 in ETSI TS 138 141-2 [2].
- 6) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 7) Measure the emission at the specified frequencies with specified *measurement bandwidth*.
- 8) Repeat step 6-7 for all directions in the appropriate TRP measurement grid needed for full TRP estimation (see annex I in ETSI TS 138 141-2 [2]).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order.

- 9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

- 10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.15.3.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.15.2.4.

5.3.16 Radiated transmit power

5.3.16.1 General

The test purpose is to verify the ability to accurately generate and direct radiated power per *beam*, for *BS type 1-H*, *BS type 1-O* and *BS type 2-O*.

5.3.16.2 Initial conditions

Test environment:

- Normal, see ETSI TS 138 141-2 [2], clause B.2.
- Extreme (*BS type 1-O* and *BS type 2-O* only), see clauses B.3 and B.5 in ETSI TS 138 141-2 [2].

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Base station RF bandwidth positions to be tested for multi-carrier and/or CA:

- B_{RFBW} , M_{RFBW} and T_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW_T'RFBW}}$ and $B'_{\text{RFBW_T'RFBW}}$ in multi-band operation, see clause 5.3.1.

Directions to be tested:

- *OTA peak directions set* reference beam direction pair (D.8); and
- *OTA peak directions set* maximum steering directions (D.10).

Beams to be tested:

- the *beam* with the highest *rated beam EIRP* (D.11); or
- the beams with highest rated beam EIRP, $P_{\text{rated,c,FBWlow}}$ (D.57) and $P_{\text{rated,c,FBWhigh}}$ (D.58), if these are provided.

Under extreme test environment, for the *BS type 1-O* and *BS type 2-O* it is sufficient to test on one NR-ARFCN or one *Base Station RF bandwidth* position, and with one applicable test configuration defined in clauses 4.7 and 4.8 in ETSI TS 138 141-2 [2]. Direction to be tested is only at *OTA peak directions set reference beam direction pair* (D.8). Testing shall be performed under extreme power supply conditions, as defined in clause B.5 in ETSI TS 138 141-2 [2].

NOTE: Tests under extreme power supply conditions also test extreme temperatures.

5.3.16.3 Procedure

For normal test environment conditions in OTA domain, the test procedure is as follows:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna
- 4) Configure the *beam peak direction* of the BS according to the *beam direction pair*.
- 5) Set the BS to transmit according to the applicable test configuration in clause 4.7 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2].

In addition, for a BS capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in clause 4.7.2 in ETSI TS 138 141-2 [2].

- 6) Measure EIRP for any two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as $\text{EIRP} = \text{EIRP}_{\text{p1}} + \text{EIRP}_{\text{p2}}$.
- 7) Test steps 3 to 6 are repeated for all *beams* (D.3) and their reference *beam direction pairs* and *maximum steering directions* (D.8 and D.10).

For multi-band capable BS and single band tests, repeat the steps above per involved *operating band* where single band test configurations and test models shall apply with no carriers activated in the other band.

- 8) For extreme test environment the methods in clause B.7 in ETSI TS 138 141-2 [2] may be used, where a representative power measurement is taken in both normal test environment ($P_{\text{max,sample,nom}}$) and extreme test environment ($P_{\text{max,sample,ext}}$) and the delta (Δ_{sample}) is added to the measurement from step 6 such that $P_{\text{max,c,EIRP,extreme}} = P_{\text{max,c,EIRP}} + \Delta_{\text{sample}}$.

5.3.16.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.16.2.

5.3.17 OTA Base Station output power

5.3.17.1 General

The test purpose is to verify the accuracy of the *maximum carrier TRP* ($P_{\max,c,TRP}$) across the frequency range for all *RIBs*.

5.3.17.2 Initial conditions

Test environment:

- Normal, see clause B.2 in ETSI TS 138 141-2 [2].

RF channels to be tested for single carrier:

- B, M, T; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- B_{RFBW} , M_{RFBW} and T_{RFBW} in single band operation; see clause 5.3.1.
- $B_{RFBW_T'RFBW}$ and $B'_{RFBW_T'RFBW}$ in multi-band operation, see clause 5.3.1.

Beams to be tested:

- As the requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.17.3 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 5 and 7. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Configure the BS such that the *beam peak direction(s)* applied during the power measurement step 6 are consistent with the grid and measurement approach for the TRP test.
- 4) Set the BS to transmit according to the applicable test configuration in clause 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2].

For a BS capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 in ETSI TS 138 141-2 [2] using the corresponding test model(s) in clause 4.9.2 in ETSI TS 138 141-2 [2] on all carriers configured.

- 5) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 6) Measure the radiated power for any two orthogonal polarizations (denoted p1 and p2) and calculate total radiated transmit power for particular *beam direction pair* as $EIRP = EIRP_{p1} + EIRP_{p2}$.

If the test chamber is a reverberation chamber measure TRP directly.

- 7) Repeat step 6-7 for all directions in the appropriate TRP measurement grid needed for full TRP estimation (see annex I in ETSI TS 138 141-2 [2]).
- 8) Calculate TRP using the EIRP measurements.

For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

5.3.17.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.17.2.

5.3.18 OTA transmitter intermodulation

5.3.18.1 General

The test purpose is to verify the ability of the transmitter units associated with the *RIB* under test to restrict the generation of intermodulation products in its nonlinear elements caused by the presence of the wanted signal and an interfering signal reaching the transmitter unit via the RDN and antenna array from a co-located base station to below specified levels.

5.3.18.2 Initial conditions

Test environment:

- Normal; see clause B.2 in ETSI TS 138 141-2 [2].

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier:

- M_{RFBW} in *single-band RIB*, see clause 5.3.1;
- $B_{\text{RFBW_T'RFBW}}$ and $B'_{\text{RFBW_T'RFBW}}$ in *multi-band RIB*, see clause 5.3.1.

In addition, for *multi-band RIB*:

- For $B_{\text{RFBW_T'RFBW}}$, emission testing above the highest *operating band* may be omitted.
- For $B'_{\text{RFBW_T'RFBW}}$, emission testing below the lowest *operating band* may be omitted.

Directions to be tested:

- The FR1 requirement is specified as co-location requirement.

5.3.18.3 Procedure

- 1) Select a CLTA according to the description in clause 4.12 in ETSI TS 138 141-2 [2] and parameters given in table 4.12.2.2-1 in ETSI TS 138 141-2 [2].
- 2) Place the CLTA according to the description in clause 4.12 in ETSI TS 138 141-2 [2] and parameters given in table 4.12.2.3-1 in ETSI TS 138 141-2 [2].
- 3) The test antenna(s) shall be dual (or single) polarized covering the same frequency range as the BS and the emission frequencies.
- 4) Several test antennas are required to cover both the BS and the whole emission frequency range.
- 5) Connect test antenna and CLTA to the measurement equipment as shown in clause E.1.5 in ETSI TS 138 141-2 [2].
- 6) During the OTA emission measurements at the test antenna conducted output(s), both BS and CLTA are rotated around same axis.
- 7) The OTA emission measurement method shall be TRP, according to the procedure described in annex I in ETSI TS 138 141-2 [2].
- 8) The measurement device (signal analyser) characteristics shall be:
 - Detection mode: True RMS.

- 9) Set the BS to transmit:
 - Set the BS to transmit maximum power according to the applicable test configuration in clause 4.7 of ETSI TS 138 141-2 [2] using the corresponding test models or set of physical channels in clause 4.9.2 of ETSI TS 138 141-2 [2].
- 10) Generate the interfering signal using test model as defined in clause 4.9.2 of ETSI TS 138 141-2 [2], at a centre frequency offset according to the conditions in table 4.3.18.2.1-1, but exclude interfering frequencies that are outside of the allocated *downlink operating band* or interfering frequencies that are not completely within the *sub-block gap* or within the *Inter RF Bandwidth gap*.
- 11) Connect the interfering signal to the CLTA input interfaces, equally dividing the power among supported polarizations. Adjust the interfering signal level at the CLTA conducted input(s) as defined in table 4.3.18.2.1-1.
- 12) If the interfering signal is applicable according to clause 4.7 of ETSI TS 138 141-2 [2], perform the unwanted emission tests specified in clauses 5.3.14 (OTA ACLR) and 5.3.13 (OTA OBUE) for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 5.3.14 and 5.3.13. The width of the intermodulation products shall be taken into account.
- 13) If the interfering signal is applicable according to clause 4.7 of ETSI TS 138 141-2 [2], perform the Transmitter spurious emissions test as specified in clause 5.3.19 (OTA spurious emission), except OTA co-location spurious emission, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 5.3.19. The width of the intermodulation products shall be taken into account.
- 14) Repeat the test for the remaining interfering signal centre frequency offsets
- 15) Repeat the test for the remaining interfering signals defined in clause 4.7 of ETSI TS 138 141-2 [2] for requirements 5.3.14 (OTA ACLR), 5.3.13 (OTA OBUE) and 5.3.19 (OTA spurious emission).

In addition, for *multi-band RIB*, the following steps shall apply:

- 16) For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

NOTE 1: The third order intermodulation products are centred at $2F1 \pm F2$ and $2F2 \pm F1$. The fifth order intermodulation products are centred at $3F1 \pm 2F2$, $3F2 \pm 2F1$, $4F1 \pm F2$, and $4F2 \pm F1$ where $F1$ represents the test signal centre frequency or centre frequency of each *sub-block* and $F2$ represents the interfering signal centre frequency. The widths of intermodulation products are:

- $(n \times BW_{F1} + m \times BW_{F2})$ for the $nF1 \pm mF2$ products;
- $(n \times BW_{F2} + m \times BW_{F1})$ for the $nF2 \pm mF1$ products;

where BW_{F1} represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or *sub-block* bandwidth and BW_{F2} represents the interfering signal channel bandwidth.

NOTE 2: During the conformance test the interferer signal can be applied on one side of the wanted signal, while the transmitter intermodulation emission is measured only on the opposite side of the wanted signal. This applies for intermodulation products which are within the *operating band* or OBUE region.

5.3.18.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.18.2.

5.3.19 OTA receiver spurious emissions

5.3.19.1 General

The test purpose is to verify if the receiver radiated spurious emissions from the BS at the RIB are within the specified limits.

5.3.19.2 Initial conditions

Test environment: Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier, see clause 5.3.1:

- For FR1:
 - B when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
- For FR2:
 - B when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 60 GHz (or to 2nd harmonic)

Base Station RF bandwidth positions to be tested in single-band operation, see clause 5.3.1:

- For FR1:
 - B_{RFBW} when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T_{RFBW} when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
- For FR2:
 - B_{RFBW} when testing from 30 MHz to $F_{DL_low} - \Delta f_{OBUE}$
 - T_{RFBW} when testing from $F_{DL_high} + \Delta f_{OBUE}$ to 60 GHz (or to 2nd harmonic)

Base Station RF bandwidth positions to be tested in multi-band operation, see clause 5.3.1:

- For FR1:
 - $B_{RFBW_T'RFBW}$ when testing from 30 MHz to $F_{DL_Blow_low} - \Delta f_{OBUE}$
 - $B'_{RFBW_T'RFBW}$ when testing from $F_{DL_Bhigh_high} + \Delta f_{OBUE}$ to 12,75 GHz (or to 5th harmonic)
 - $B_{RFBW_T'RFBW}$ and $B'_{RFBW_T'RFBW}$ when testing from $F_{DL_Blow_high} + \Delta f_{OBUE}$ to $F_{DL_Bhigh_low} - \Delta f_{OBUE}$

Directions to be tested:

- As the requirement is TRP the beam pattern(s) may be set up to optimize the TRP measurement procedure (see annex I in ETSI TS 138 141-2 [2]) as long as the required TRP level is achieved.

5.3.19.3 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I in ETSI TS 138 141-2 [2]. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber. If so, follow steps 1, 3, 4, 5, 7 and 10. When calibrated and operated within the guidance of ETSI TR 137 941 [i.28] the two methods are applicable and selected due to availability of test facility:

- 1) Place the BS at the positioner.
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Measurements shall use a *measurement bandwidth* in accordance to the conditions in clause 4.3.19.2.
- 4) The measurement device characteristics shall be:
 - Detection mode:
 - True RMS.
- 5) Set the TDD BS to receive only.

- 6) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I in ETSI TS 138 141-2 [2]).
- 7) Measure the emission at the specified frequencies with specified *measurement bandwidth*.
- 8) Repeat step 6-9 for all directions in the appropriate TRP measurement grid needed for full TRP estimation (see annex I in ETSI TS 138 141-2 [2]).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order.

- 9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

- 10) For *BS type 1-O* and *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.19.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.19.2.

5.3.20 OTA In-band blocking

5.3.20.1 General

The test purpose is to verify the ability of the *BS receiver* to withstand high-levels of in-band interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity.

5.3.20.2 Initial conditions

Test environment:

- Normal, see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth edge position to be tested for multi-carrier and/or CA:

- M_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW_T_RFBW}}$ and $B'_{\text{RFBW_T_RFBW}}$ in multi-band operation, see clause 5.3.1.

Directions to be tested:

For *BS type 1-O*:

- *receiver target reference direction* for the *minSENS* OSDD (D.31);
- OTA REFSSENS conformance test directions (D.55).

For *BS type 2-O*:

- OTA REFSSENS *receiver target reference direction* (D.54);
- OTA REFSSENS conformance test directions (D.55).

5.3.20.3 Procedure

- 1) Place the BS with its coordinate system reference point in the same place as calibrated point in the test system, as shown in clause E.2.3 in ETSI TS 138 141-2 [2].
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Align the BS with the test antenna in the direction to be tested.
- 4) Align the BS so that the wanted signal and interferer signal is *polarization matched* with the test antenna(s).
- 5) Set the test signal mean power so that the calibrated radiated power at the BS Antenna Array coordinate system reference point is as follows:
 - a) Set the signal generator for the wanted signal to transmit as specified in table 4.3.20.2.1-2 for *BS type 1-O* and table 4.3.20.2.2-2 for *BS type 2-O*.
 - b) Set the signal generator for the interfering signal at the specified frequency offset from the wanted signal to transmit as specified in table 4.3.20.2.1-2 for *BS type 1-O* and table 4.3.20.2.2-2 for *BS type 2-O*.
- 6) Measure throughput according to FRC for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in clause 4.7.2 in ETSI TS 138 141-2 [2].
- 7) Repeat steps 3 to 6 for all the specified measurement directions.

For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

5.3.20.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.20.2.

5.3.21 OTA Out-of-band blocking

5.3.21.1 General

The test stresses the ability of the receiver unit associated with the *RIB* under test to withstand high-level interference from unwanted signals at specified frequency bands, without undue degradation of its sensitivity.

5.3.21.2 Initial conditions

Test environment:

- Normal; see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for Single Carrier (SC):

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for Multi-Carrier (MC):

- M_{RFBW} in *single-band RIB*, see clause 5.3.1; $B_{\text{RFBW}}T_{\text{RFBW}}$ and $B'_{\text{RFBW}}T_{\text{RFBW}}$ in *multi-band RIB*, see clause 5.3.1.

In addition, for *multi-band RIB*:

- For $B_{\text{RFBW}}T_{\text{RFBW}}$, blocking testing above the highest *operating band* may be omitted.
- For $B'_{\text{RFBW}}T_{\text{RFBW}}$, blocking testing below the lowest *operating band* may be omitted.

Directions to be tested:

- For *BS type 1-O*, receiver target reference direction (D.31).

- For *BS type 2-O*, *OTA REFSENS receiver target reference direction* (D.62).

5.3.21.3 Procedure

5.3.21.3.1 *BS type 1-O* procedure for out-of-band blocking

- 1) Place BS and the test antenna(s) according to clause E.2.4.1 in ETSI TS 138 141-2 [2].
- 2) Align the BS and test antenna(s) according to the directions to be tested.
- 3) Connect test antenna(s) to the measurement equipment as shown in clause E.2.4.1 in ETSI TS 138 141-2 [2].
- 4) The test antenna(s) shall be dual (or single) polarized covering the same frequency ranges as the *BS* and the blocking frequencies. If the test antenna does not cover both the wanted and interfering signal frequencies, separate test antennas for the wanted and interfering signal are required.
- 5) The OTA blocking interferer is injected into the test antenna, with the blocking interferer producing specified interferer field strength level for each supported polarization. The interferer shall be *polarization matched* in-band and the polarization maintained for out-of-band frequencies.
- 6) Generate the wanted signal in *receiver target reference direction*, according to the applicable test configuration (see clause 4.8 in ETSI TS 138 141-2 [2]) using applicable reference measurement channel to the RIB.
- 7) Configure the *beam peak direction* for the transmitter units associated with the RIB under test according to the *reference beam direction pair* for the *appropriate beam identifier* with the carrier set-up and power allocation according to the applicable test configuration(s) (see clause 4.8 in ETSI TS 138 141-2 [2]). The transmitter may be turned off for the out-of-band blocker tests when the frequency of the blocker is such that no IM2 or IM3 products fall inside the bandwidth of the wanted signal.
- 8) Adjust the signal generators to the type of interfering signals, levels and the frequency offsets as specified for general blocking limits in table 4.3.21.2.1-1. The distance between the test object and test antenna injecting the interferer signal is adjusted when necessary to ensure specified interferer signal level to be received.
- 9) The CW interfering signal shall be swept with a step size of 1 MHz within the frequency range specified in clause 4.3.21.2.1.
- 10) Measure the throughput of the wanted signal at the receiver unit associated with the RIB, as defined in clause 4.3.21.2.1, for the relevant carriers specified by the test configuration in clause 4.7 in ETSI TS 138 141-2 [2].
- 11) Repeat for all supported polarizations.

In addition, for *multi-band RIB*, the following steps shall apply:

- 12) For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.21.3.2 *BS type 2-O* procedure for out-of-band blocking

- 1) Place BS and the test antenna(s) according to clause E.2.4.1 in ETSI TS 138 141-2 [2].
- 2) Align the BS and test antenna(s) according to the directions to be tested.
- 3) Connect test antenna(s) to the measurement equipment as shown in clause E.2.4.1 in ETSI TS 138 141-2 [2].
- 4) The test antenna(s) shall be dual (or single) polarized covering the same frequency ranges as the *BS* and the blocking frequencies. If the test antenna does not cover both the wanted and interfering signal frequencies, separate test antennas for the wanted and interfering signal are required.
- 5) The OTA blocking interferer is injected into the test antenna, with the blocking interferer producing specified interferer field strength level for each supported polarization. The interferer shall be *polarization matched* in-band and the polarization maintained for out-of-band frequencies.

Generate the wanted signal, according to the applicable test configuration, see clause 4.7 in ETSI TS 138 141-2 [2]) using applicable reference measurement channel to the RIB for the supported *BS channel bandwidths*, as described in table 4.3.24.2-1.

- 6) Adjust the signal generators to the type of interfering signals, levels and frequency offsets as specified for general blocking limits in table 4.3.21.2.2-1. The distance between the test object and test antenna injecting the interferer signal is adjusted when necessary to ensure a specified interferer signal level to be received.
- 7) The interfering signal shall be swept within the frequency range specified in clause 4.3.21.2.1 and step size specified in table 5.3.21.3.2-1.
- 8) Measure the throughput of the wanted signal at the receiver unit associated with the RIB, as defined in clause 4.3.21.2.2, for the relevant carriers specified by the test configuration in clauses 4.7 and 4.8 in ETSI TS 138 141-2 [2].

Table 5.3.21.3.2-1: Interferer signal step size

Frequency range (MHz)	Minimum supported <i>BS channel bandwidth</i> (MHz)	Measurement step size (MHz)
30 to 6 000	50, 100, 200, 400	1
6 000 to 60 000	50	15
	100	30
	200	60
	400	60

- 9) Repeat for all supported polarizations.

5.3.21.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.21.2.

5.3.22 OTA receiver intermodulation

5.3.22.1 General

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver unit to receive a wanted signal on its assigned channel frequency in the presence of two interfering signals which have a specific frequency relationship to the wanted signal.

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

5.3.22.2 Initial conditions

Test environment:

- Normal, ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth positions to be tested for multi-carrier and/or CA:

- M_{RFBW} for single-band operation, see clause 5.3.1;
- $B_{RFBW_T_{RFBW}}$ and $B'_{RFBW_T_{RFBW}}$ for multi-band operation, see clause 5.3.1.

Directions to be tested:

- OTA REFSSENS *receiver target reference direction* (D.54).

- In addition, for *BS type 1-O*, receiver target reference direction (D.31).

5.3.22.3 Procedure

- 1) Place the BS with its coordinate system reference point in the same place as calibrated point in the test system, as shown in clause E.2.6 in ETSI TS 138 141-2 [2].
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Align the BS with the test antenna in the direction to be tested.
- 4) Align the BS so that the wanted signal and interferer signal is *polarization matched* with the test antenna(s).
- 5) Configure the *beam peak direction* of the BS according to the reference *beam direction pair* for the appropriate *beam* identifier.
- 6) For FDD operation, set the BS to transmit the *beam(s)* of the same operational band as the *OTA REFSENS RoAoA* or OSDD being tested according to the appropriate test configuration in clauses 4.7 and 4.8 in ETSI TS 138 141-2 [2].
- 7) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified as follows:
 - a) Set the signal generator for the wanted signal to transmit as specified in table 4.3.22.2.1-1 (for general intermodulation) or 4.3.22.2.1-3 (for narrowband intermodulation) for *BS type 1-O*, or table 4.3.22.2.2-1 (for general intermodulation) for *BS type 2-O*.
 - b) Set the signal generator for the interfering signal at the same frequency as the wanted signal to transmit as specified in table 4.3.22.2.1-1 (for general intermodulation) or 4.3.22.2.1-3 (for narrowband intermodulation) for *BS type 1-O*, or table 4.3.22.2.2-1 (for general intermodulation) for *BS type 2-O*.
- 8) Set the signal generator for the interfering signal to transmit at the frequency offset and as specified in table 4.3.22.2.1-2 (for general intermodulation) or 4.3.22.2.1-4 (for narrowband intermodulation) for *BS type 1-O*, or table 4.3.22.2.2-2 (for general intermodulation) for *BS type 2-O*.
- 9) Measure the throughput according to clause A.1 in ETSI TS 138 141-2 [2] for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in clause 4.7 in ETSI TS 138 141-2 [2].
- 10) Repeat for all the specified measurement directions and supported polarizations.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

- 11) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

5.3.22.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.22.2.

5.3.23 OTA Adjacent Channel Selectivity (ACS)

5.3.23.1 General

The test purpose is to verify the ability of the *BS receiver* filter to suppress interfering signals in the channels adjacent to the wanted channel.

5.3.23.2 Initial conditions

Test environment:

- Normal, see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- M; see clause 5.3.1.

Base Station RF Bandwidth edge position to be tested for multi-carrier and/or CA:

- M_{RFBW} in single-band operation, see clause 5.3.1;
- $B_{\text{RFBW_T}}'_{\text{RFBW}}$ and $B'_{\text{RFBW_T}}_{\text{RFBW}}$ in multi-band operation, see clause 5.3.1.

Directions to be tested:

- For *BS type 1-O*, receiver target reference direction (D.31).
- For *BS type 2-O*, OTA REFSENS receiver target reference direction (D.54).

5.3.23.3 Procedure

- 1) Place the BS with its coordinate system reference point in the same place as calibrated point in the test system, as shown in clause E.2.3 in ETSI TS 138 141-2 [2].
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Align the BS with the test antenna in the direction to be tested.
- 4) Align the BS to that the wanted signal and interferer signal is *polarization matched* with the test antenna(s).
- 5) Set the test signal mean power so that the calibrated radiated power at the BS Antenna Array coordinate system reference point is as follows:
 - a) Set the signal generator for the wanted signal to transmit as specified in table 4.3.23.2.1-1 for *BS type 1-O* and table 4.3.23.2.2-1 for *BS type 2-O*.
 - b) Set the signal generator for the interfering signal at the adjacent channel frequency of the wanted signal to transmit as specified in table 4.3.23.2.1-1 for *BS type 1-O* and table 4.3.23.2.2-1 for *BS type 2-O*.
- 6) Measure throughput according to FRC for each supported polarization, for multi-carrier and/or CA operation the throughput shall be measured for relevant carriers specified by the test configuration specified in clauses 4.7.2 and 4.8 in ETSI TS 138 141-2 [2].

For *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

5.3.23.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.23.2.

5.3.24 OTA sensitivity

5.3.24.1 General

The test purpose is to verify that the BS can meet the throughput requirement for a specified measurement channel at the EIS level and the range of angles of arrival in the OSDD.

5.3.24.2 Initial conditions

Test environment: Normal, see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier: M; see clause 5.3.1.

Directions to be tested:

- receiver target reference direction (D.31);

- conformance test directions (D.33).

5.3.24.3 Procedure

- 1) Place the BS with its coordinate system reference point in the same place as calibrated point in the test system, as shown in ETSI TS 138 141-2 [2], clause E.2.1.
- 2) Align the coordinate system orientation of the BS with the test system.
- 3) Align the BS with the test antenna in the direction to be tested.
- 4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the BS under test.
- 5) Configure the *beam peak direction* of the BS according to reference *beam direction pair* for the appropriate *beam* identifier.
- 6) For FDD operation, set the BS to transmit *beam(s)* of the same operational band as the OSDD being tested according to the appropriate test configuration in clause 4.7 in ETSI TS 138 141-2 [2].
- 7) Start the signal generator for the wanted signal to transmit:
 - The test signal as specified in clause 4.3.24.2 in ETSI TS 138 141-2 [2].
- 8) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified in table 4.3.24.2-1.
- 9) Measure throughput according to FRC for each supported polarization.
- 10) Repeat steps 3 to 9 for all OSDD(s) for the BS (D.23) and supported polarizations.

For multi-band capable BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

5.3.24.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.24.2.

5.3.25 OTA Reference sensitivity

5.3.25.1 General

The test purpose is to verify that the BS can meet the throughput requirement for a specified measurement channel at the $EIS_{REFSENS}$ level and the range of angles of arrival within the *OTA REFSENS RoAoA*.

5.3.25.2 Initial conditions

Test environment:

- Normal, see ETSI TS 138 141-2 [2], clause B.2.

RF channels to be tested for single carrier:

- B, M and T; see clause 5.3.1.

Directions to be tested:

- *OTA REFSENS receiver target reference direction* (D.54);
- *OTA REFSENS conformance test directions* (D.55).

5.3.25.3 Procedure

- 1) Place the BS with its coordinate system reference point in the same place as calibrated point in the test system, as shown in clause E.2.1 in ETSI TS 138 141-2 [2].
- 2) Align the coordinate system orientation (D.2) of the BS with the test system.
- 3) Align the BS with the test antenna in the direction to be tested.
- 4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the BS under test.
- 5) Configure the *beam peak direction* of the BS according to the *OTA REFSENS RoAoA* for the appropriate *beam* identifier.
- 6) For FDD operation, set the BS to transmit *beam(s)* of the same operational band as the *OTA REFSENS RoAoA* being tested according to the appropriate test configuration in clause 4.7 in ETSI TS 138 141-2 [2].
- 7) Start the signal generator for the wanted signal to transmit:
 - The test signal as specified in clause 4.3.25.2.
- 8) Set the test signal mean power so the calibrated radiated power at the BS Antenna Array coordinate system reference point is as specified in clause 4.3.25.2.
- 9) Measure throughput according to FRC for each supported polarization.
- 10) Repeat steps 3 to 9 for all OTA REFSENS conformance test directions of the BS (D.55), and supported polarizations.

For multi-band capable FR1 BS and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carriers activated in the other band.

5.3.25.4 Test Requirement

The results shall fulfil the conditions and limits of clause 4.3.25.2.

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.1] 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.1].

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 301 908-24					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Operating band unwanted emissions	3.2	4.3.2	C	Only applicable to BS type 1-C and BS type 1-H
2	Adjacent Channel Leakage power Ratio (ACLR)	3.2	4.3.3	C	Only applicable to BS type 1-C and BS type 1-H
3	Transmitter spurious emissions	3.2	4.3.4	C	Only applicable to BS type 1-C and BS type 1-H
4	Base Station output power	3.2	4.3.5	C	Only applicable to BS type 1-C and BS type 1-H
5	Transmit intermodulation	3.2	4.3.6	C	Only applicable to BS type 1-C and BS type 1-H
6	Receiver spurious emissions	3.2	4.3.7	C	Only applicable to BS type 1-C and BS type 1-H
7	In-band blocking	3.2	4.3.8	C	Only applicable to BS type 1-C and BS type 1-H
8	Out-of-band blocking	3.2	4.3.9	C	Only applicable to BS type 1-C and BS type 1-H
9	Receiver intermodulation	3.2	4.3.10	C	Only applicable to BS type 1-C and BS type 1-H
10	Adjacent Channel Selectivity (ACS)	3.2	4.3.11	C	Only applicable to BS type 1-C and BS type 1-H
11	Reference sensitivity level	3.2	4.3.12	C	Only applicable to BS type 1-C and BS type 1-H
12	OTA operating band unwanted emissions	3.2	4.3.13	C	Only Applicable to BS type 1-O and 2-O
13	OTA Adjacent Channel Leakage power Ratio (ACLR)	3.2	4.3.14	C	Only Applicable to BS type 1-O and 2-O
14	OTA transmitter spurious emissions	3.2	4.3.15	C	Only Applicable to BS type 1-O and 2-O

Harmonised Standard ETSI EN 301 908-24					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
15	Radiated transmit power	3.2	4.3.16	C	Only Applicable to BS type 1-O, 1-H and 2-O
16	OTA Base Station output power	3.2	4.3.17	C	Only Applicable to BS type 1-O and 2-O
17	OTA transmitter intermodulation	3.2	4.3.18	C	Only Applicable to BS type 1-O
18	OTA receiver spurious emissions	3.2	4.3.19	C	Only Applicable to BS type 1-O and 2-O
19	OTA In-band blocking	3.2	4.3.20	C	Only Applicable to BS type 1-O and 2-O
20	OTA Out-of-band blocking	3.2	4.3.21	C	Only Applicable to BS type 1-O and 2-O
21	OTA Receiver intermodulation	3.2	4.3.22	C	Only Applicable to BS type 1-O and 2-O
22	OTA Adjacent Channel Selectivity (ACS)	3.2	4.3.23	C	Only Applicable to BS type 1-O and 2-O
23	OTA Sensitivity	3.2	4.3.24	C	Only applicable to BS type 1-O and BS type 1-H
24	OTA Reference sensitivity	3.2	4.3.25	C	Only Applicable to BS type 1-O and 2-O

Key to columns:**Requirement:**

No A unique identifier for one row of the table 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 that 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 (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.

For the test methods, the recommended values of the maximum measurement uncertainty are calculated and correspond to an expansion factor (coverage factor) $k = 1,96$ (which provide a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.5], in particular in annex D of ETSI TR 100 028-2 [i.5].

Tables B-1 to B-6 show the recommended values for the maximum measurement uncertainty figures.

Table B-1: Maximum measurement uncertainty for conducted transmitter tests

Parameter	Condition	Uncertainty
Base Station output power	$f \leq 3$ GHz 3 GHz $< f \leq 4,2$ GHz	$\pm 0,7$ dB $\pm 1,0$ dB
Adjacent Channel Leakage power Ratio (ACLR)	ACLR BW ≤ 20 MHz: BW > 20 MHz: For absolute power limits: $f \leq 3$ GHz 3 GHz $< f \leq 6$ GHz CACLR BW ≤ 20 MHz BW > 20 MHz For absolute power limits $f \leq 3$ GHz 3 GHz $< f \leq 4,2$ GHz	$\pm 0,8$ dB $\pm 1,2$ dB $\pm 2,0$ dB $\pm 2,5$ dB $\pm 0,8$ dB $\pm 1,2$ dB $\pm 2,0$ dB $\pm 2,5$ dB
6.6.4 Operating band unwanted emissions	$f \leq 3$ GHz 3 GHz $< f \leq 6$ GHz	$\pm 1,5$ dB $\pm 1,8$ dB
Transmitter spurious emissions, General Requirements	9 kHz $< f \leq 4$ GHz 4 GHz $< f \leq 19$ GHz 19 GHz $< f \leq 26$ GHz	$\pm 2,0$ dB $\pm 4,0$ dB $\pm 4,5$ dB
Transmitter spurious emissions, Protection of BS receiver		$\pm 3,0$ dB
Transmitter spurious emissions, Co-existence requirements	> -60 dBm $f \leq 3$ GHz 3 GHz $< f \leq 4,2$ GHz ≤ -60 dBm $f \leq 3$ GHz 3 GHz $< f \leq 4,2$ GHz	$\pm 2,0$ dB $\pm 2,5$ dB $\pm 3,0$ dB $\pm 3,5$ dB
Transmitter intermodulation (interferer requirements) This tolerance applies to the stimulus and not the measurements defined in clauses 4.3.2, 4.3.3 and 4.3.4	The value applies only to the interfering signal and is unrelated to the measurement uncertainty of the tests in clauses 4.3.2 (OBUE), 4.3.3 (ACLR) and 4.3.4 (TX spurious)) which is carried out in the presence of the interferer.	$\pm 1,0$ dB
NOTE 1: For RF tests, the uncertainties in table B-1 apply to the test system operating into a nominal 50 Ω load and do not include system effects due to a mismatch between the EUT and the Test System.		
NOTE 2: Annex G of ETSI TR 100 028-2 [i.5] guides the calculation of the uncertainty components relating to mismatch.		

Table B-2: Maximum measurement uncertainty for conducted receiver tests

Parameter	Condition	Uncertainty
Reference sensitivity level	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 0,7 \text{ dB}$ $\pm 1,0 \text{ dB}$
Adjacent channel selectivity	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,4 \text{ dB}$ $\pm 1,8 \text{ dB}$
In-band blocking (General blocking)	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,6 \text{ dB}$ $\pm 2,0 \text{ dB}$
In-band blocking (Narrow band blocking)	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,4 \text{ dB}$ $\pm 1,8 \text{ dB}$
Out-of-band blocking (General requirements)	$f_{\text{wanted}} \leq 3 \text{ GHz}$: $1 \text{ MHz} < f_{\text{interferer}} \leq 3 \text{ GHz}$ $3,0 \text{ GHz} < f_{\text{interferer}} \leq 4,2 \text{ GHz}$ $4,2 \text{ GHz} < f_{\text{interferer}} \leq 12,75 \text{ GHz}$ $3 \text{ GHz} < f_{\text{wanted}} \leq 4,2 \text{ GHz}$: $1 \text{ MHz} < f_{\text{interferer}} \leq 3 \text{ GHz}$ $3,0 \text{ GHz} < f_{\text{interferer}} \leq 4,2 \text{ GHz}$ $4,2 \text{ GHz} < f_{\text{interferer}} \leq 12,75 \text{ GHz}$	$\pm 1,3 \text{ dB}$ $\pm 1,5 \text{ dB}$ $\pm 3,2 \text{ dB}$ $\pm 1,5 \text{ dB}$ $\pm 1,7 \text{ dB}$ $\pm 3,3 \text{ dB}$
Receiver spurious emissions	$30 \text{ MHz} \leq f \leq 4 \text{ GHz}$ $4 \text{ GHz} < f \leq 19 \text{ GHz}$ $19 \text{ GHz} < f \leq 26 \text{ GHz}$	$\pm 2,0 \text{ dB}$ $\pm 4,0 \text{ dB}$ $\pm 4,5 \text{ dB}$
Receiver intermodulation	$f \leq 3,0 \text{ GHz}$ $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,8 \text{ dB}$ $\pm 2,4 \text{ dB}$
NOTE 1: For RF tests, the uncertainties in table B-2 apply to the test system operating into a nominal 50 Ω load and do not include system effects due to a mismatch between the EUT and the Test System.		
NOTE 2: Annex G of ETSI TR 100 028-2 [i.5] provides guidance for the calculation of the uncertainty components relating to mismatch.		

Table B-3: Maximum measurement uncertainty for FR1 OTA transmitter tests

Parameter	Condition	Uncertainty
Radiated transmit power	Normal test environment:	
	$f \leq 3 \text{ GHz}$	$\pm 1,1 \text{ dB}$
	$3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,3 \text{ dB}$
	Extreme test environment:	
	$f \leq 3 \text{ GHz}$	$\pm 2,5 \text{ dB}$
	$3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 2,6 \text{ dB}$
OTA base station output power	$f \leq 3,0 \text{ GHz}$ $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,4 \text{ dB}$ $\pm 1,5 \text{ dB}$
OTA ACLR	ACLR/CACLR $f \leq 3,0 \text{ GHz}$ BW $\leq 20 \text{ MHz}$: BW $> 20 \text{ MHz}$: $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ BW $\leq 20 \text{ MHz}$: BW $> 20 \text{ MHz}$: Absolute power limits: $f \leq 3,0 \text{ GHz}$ $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1 \text{ dB}$ $\pm 1 \text{ dB}$ $\pm 1,2 \text{ dB}$ $\pm 1,2 \text{ dB}$ $\pm 2,2 \text{ dB}$ $\pm 2,7 \text{ dB}$
OTA operating band unwanted emissions (absolute power)	$f \leq 3,0 \text{ GHz}$ $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,8 \text{ dB}$ $\pm 2,0 \text{ dB}$
OTA transmitter spurious emissions, mandatory requirements	$30 \text{ MHz} < f \leq 6 \text{ GHz}$ $6 \text{ GHz} < f \leq 26 \text{ GHz}$	$\pm 2,3 \text{ dB}$ $\pm 4,2 \text{ dB}$
OTA transmitter spurious emissions, protection of BS receiver	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 3,1 \text{ dB}$ $\pm 3,3 \text{ dB}$
OTA transmitter spurious emissions, co-existence	$f \leq 3 \text{ GHz}$ $3 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 2,6 \text{ dB}$ $\pm 3,0 \text{ dB}$
OTA transmitter intermodulation	The value below applies only to the interfering signal and is unrelated to the measurement uncertainty of the tests in clauses 4.3.13 (OTA OBUE), 4.3.14 (OTA ACLR) and 4.3.15 (OTA spurious emissions) which are carried out in the presence of the interferer. $f \leq 3,0 \text{ GHz}$ $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 3,2 \text{ dB}$ $\pm 3,4 \text{ dB}$
NOTE: Test system uncertainty values are applicable for the normal test environment, unless otherwise stated.		

Table B-4: Maximum measurement uncertainty for FR2 OTA transmitter tests

Parameter	Condition	Uncertainty
Radiated transmit power	Normal test environment:	$\pm 1,7 \text{ dB}$
OTA base station output power	Extreme test environment:	$\pm 3,1 \text{ dB}$
OTA ACLR	Relative ACLR:	$\pm 2,3 \text{ dB}$
	Absolute ACLR:	$\pm 2,7 \text{ dB}$
OTA operating band unwanted emissions		$\pm 2,7 \text{ dB}$
OTA transmitter spurious emissions, mandatory requirements	$30 \text{ MHz} \leq f \leq 6 \text{ GHz}$	$\pm 2,3 \text{ dB}$
	$6 \text{ GHz} < f \leq 40 \text{ GHz}$	$\pm 2,7 \text{ dB}$
	$40 \text{ GHz} < f \leq 60 \text{ GHz}$	$\pm 5,0 \text{ dB}$
OTA transmitter spurious emissions, additional requirements	$30 \text{ MHz} \leq f \leq 6 \text{ GHz}$	$\pm 2,3 \text{ dB}$
	$6 \text{ GHz} < f \leq 40 \text{ GHz}$	$\pm 2,7 \text{ dB}$
	$40 \text{ GHz} < f \leq 60 \text{ GHz}$	$\pm 5,0 \text{ dB}$

Table B-5: Maximum measurement uncertainty for FR1 OTA receiver tests

Parameter	Condition	Uncertainty
OTA sensitivity	$f \leq 3,0 \text{ GHz}$	$\pm 1,3 \text{ dB}$
	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,4 \text{ dB}$
OTA reference sensitivity level	$f \leq 3,0 \text{ GHz}$	$\pm 1,3 \text{ dB}$
	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 1,4 \text{ dB}$
OTA adjacent channel selectivity	$f \leq 3,0 \text{ GHz}$	$\pm 1,7 \text{ dB}$
	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 2,1 \text{ dB}$
OTA out-of-band blocking	$f_{\text{wanted}} \leq 3 \text{ GHz}$	
	$1 \text{ MHz} < f_{\text{interferer}} \leq 3 \text{ GHz}$	$\pm 2,0 \text{ dB}$
	$3 \text{ GHz} < f_{\text{interferer}} \leq 6 \text{ GHz}$	$\pm 2,1 \text{ dB}$
	$6 \text{ GHz} < f_{\text{interferer}} \leq 12,75 \text{ GHz}$	$\pm 3,5 \text{ dB}$
	$3 \text{ GHz} < f_{\text{wanted}} \leq 4,2 \text{ GHz}$:	
	$1 \text{ MHz} < f_{\text{interferer}} \leq 3 \text{ GHz}$	$\pm 2,0 \text{ dB}$
OTA receiver spurious emissions	$30 \text{ MHz} \leq f \leq 6 \text{ GHz}$	$\pm 2,5 \text{ dB}$
	$6 \text{ GHz} < f \leq 26 \text{ GHz}$	$\pm 4,2 \text{ dB}$
OTA receiver intermodulation	$f \leq 3,0 \text{ GHz}$	$\pm 2,0 \text{ dB}$
	$3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$	$\pm 2,6 \text{ dB}$
NOTE: Test system uncertainty values are applicable for the normal test environment.		

Table B-6: Maximum measurement uncertainty for FR2 OTA receiver tests

Parameter	Condition	Uncertainty
OTA reference sensitivity level		$\pm 2,4 \text{ dB}$
OTA adjacent channel selectivity		$\pm 3,4 \text{ dB}$
OTA in-band blocking		$\pm 3,4 \text{ dB}$
OTA out-of-band blocking		$\pm 4,1 \text{ dB}$
OTA receiver spurious emissions	$30 \text{ MHz} \leq f \leq 6 \text{ GHz}$	$\pm 2,5 \text{ dB}$
	$6 \text{ GHz} < f \leq 40 \text{ GHz}$	$\pm 2,7 \text{ dB}$
	$40 \text{ GHz} < f \leq 60 \text{ GHz}$	$\pm 5,0 \text{ dB}$
OTA receiver intermodulation		$\pm 3,9 \text{ dB}$
NOTE: Test system uncertainty values are applicable for the normal test environment.		

Annex C (normative): BS configurations for conducted testing

C.1 *BS type 1-C*

C.1.1 Transmit configurations

C.1.1.1 General

Transmitter characteristics in clause 4 are specified at the BS *antenna connector* (test port A) with a full complement of transceivers for the configuration in normal operation. If any external apparatus such as a TX amplifier, a filter or the combination of such devices is used, requirements apply at the far end *antenna connector* (test port B).

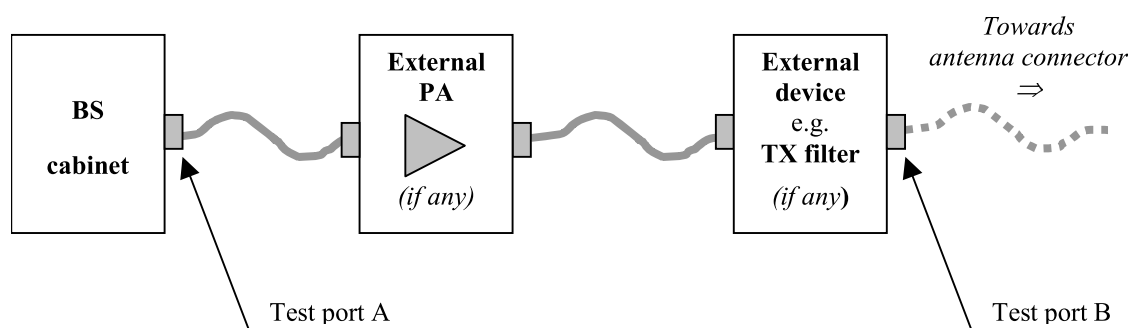


Figure C.1.1.1-1: Transmitter test ports

C.1.1.2 Transmission with multiple transmitter antenna connectors

For the tests in clause 5 of the present document, the requirement applies for each transmitter *antenna connector* in the case of transmission with multiple transmitter *antenna connectors*.

Transmitter requirements are tested at the *antenna connector*, with the remaining *antenna connector(s)* being terminated.

C.1.2 Receive configurations

C.1.2.1 General

Receiver characteristics are specified at the BS *antenna connector* (test port A) with a full complement of transceivers for the configuration in normal operation. If any external apparatus such as a RX amplifier, a filter or a combination of such devices are used, requirements apply at the far end *antenna connector* (test port B).

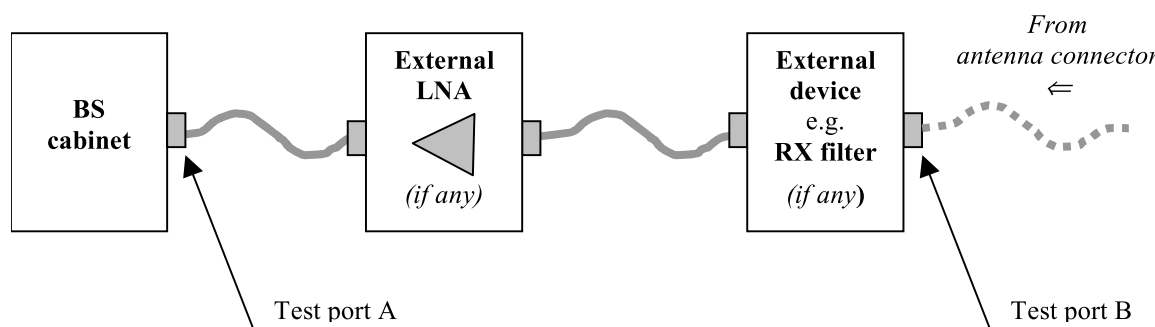


Figure C.1.2.1-1: Receiver test ports

C.1.2.2 Reception with multiple receiver antenna connectors, receiver diversity

For the tests in clause 5 of the present document, the requirement applies at each receiver *antenna connector* for receivers with antenna diversity or in the case of multi-carrier reception with multiple receiver *antenna connectors*.

Receiver requirements are tested at the *antenna connector*, with the remaining receiver(s) disabled or their *antenna connector(s)* being terminated.

For a *BS type 1-C* supporting multi-band operation, multi-band tests for ACS, blocking and intermodulation are performed with the interferer(s) applied to each *antenna connector* mapped to the receiver for the wanted signal(s), however only to one *antenna connector* at a time. *Antenna connectors* to which no signals are applied are terminated.

C.1.3 Duplexers

The requirements of the present document shall be met with a duplexer fitted if a duplexer is supplied as part of the BS. If the duplexer is supplied as an option by the manufacturer, sufficient tests should be repeated with and without the duplexer fitted to verify that the BS meets the requirements of the present document in both cases.

The following tests shall be performed with the duplexer fitted, and without it if this is an option:

- 1) Clause 5.3.5, base station output power, for the highest static power step only, if this is measured at the *antenna connector*.
- 2) Clause 5.3.2, unwanted emissions; outside the BS transmit band.
- 3) Clause 4.3.4.2.2, protection of the *BS receiver*.
- 4) Clause 5.3.6, transmit intermodulation; for the testing of conformance, the carrier frequencies should be selected to minimize intermodulation products from the transmitters falling in receive channels.

The remaining tests may be performed with or without the duplexer fitted.

NOTE 1: When performing receiver tests with a duplexer fitted, it is important to ensure that the output from the transmitters does not affect the test apparatus. This can be achieved using a combination of attenuators, isolators and filters.

NOTE 2: When duplexers are used, intermodulation products will be generated, not only in the duplexer but also in the antenna system. The intermodulation products generated in the antenna system are not controlled by 3GPP specifications and may degrade during operation (e.g. due to moisture ingress). Therefore, to ensure the continued satisfactory operation of a BS, an operator will normally select NR-ARFCNs to minimize intermodulation products falling on receive channels. For testing of complete conformance, an operator may specify the NR-ARFCNs to be used.

C.1.4 Power supply options

If the BS is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

This applies particularly if a BS contains a DC rail which can be supplied either externally or from an internal mains power supply. In this case, the conditions of extreme power supply for the mains power supply options can be tested by testing only the external DC supply option. The range of DC input voltages for the test should be sufficient to verify the performance with any of the power supplies, over its range of operating conditions within the BS, including variation of mains input voltage, temperature and output current.

C.1.5 Ancillary RF amplifiers

The *BS type 1-C* requirements of the present document shall be met with the ancillary RF amplifier fitted. At tests for TX and RX respectively, the ancillary amplifier is connected to the BS by a connecting network (including any cable(s), attenuator(s), etc.) with an applicable loss to make sure the appropriate operating conditions of the ancillary amplifier and the BS. The applicable connecting network loss range is provided by the manufacturer (D.35). Other characteristics and the temperature dependence of the attenuation of the connecting network are neglected. The lowest value for connecting network loss is applied except in the base station output power test (clause 5.3.5) and reference sensitivity level test (clause 5.3.12) where highest connecting network loss value is applied.

Sufficient tests should be repeated with the ancillary amplifier fitted and, if it is optional, without the ancillary RF amplifier to verify that the BS meets the requirements of the present document in both cases.

When testing, the following tests shall be repeated with the optional ancillary amplifier fitted according to the table below, where "x" denotes that the test is applicable:

Table C.1.5-1: Tests applicable to ancillary RF amplifiers

	Clause	TX amplifier only	RX amplifier only	TX/RX amplifiers combined (notes 1 and 2)
Receiver tests	5.3.12		x	x
	5.3.8 (Narrowband blocking)		x	x
	5.3.9		x	x
	5.3.7		x	x
	5.3.10		x	
Transmitter tests	5.3.5	x		x
	5.3.3	x		x
	5.3.2	x		x
	5.3.4	x		x
	5.3.6	x		x
NOTE 1: Combining can be by duplex filters or any other network. The amplifiers can either be in RX or TX branch or in both. Either one of these amplifiers could be a passive network.				
NOTE 2: BS with both TX and RX amplifiers are tested once with both amplifiers active for each test.				

C.2 BS type 1-H

C.2.1 Transmit configurations

Conducted transmitter characteristics in clause 4 are specified at the *transceiver array boundary* at the *TAB connector(s)* with a full complement of transceiver units for the configuration in normal operation.

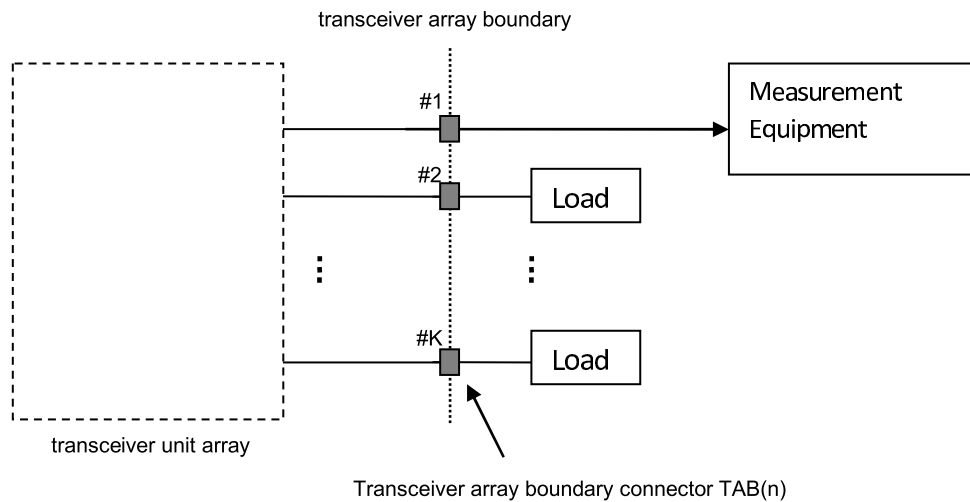


Figure C.2.1-1: Transmitter test ports

C.2.2 Receive configurations

Conducted receiver characteristics in clause 4 are specified at the *TAB connector* with a full complement of transceiver units for the configuration in normal operation.

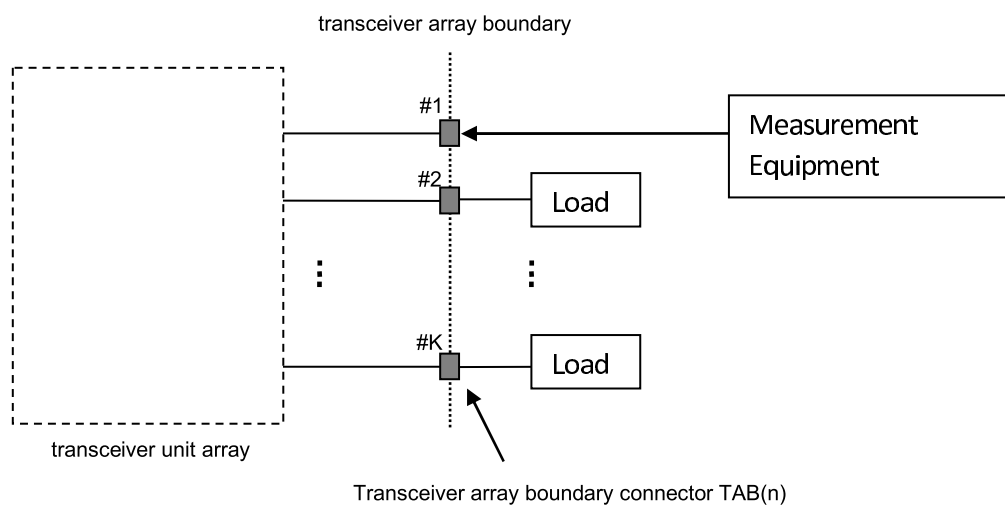


Figure C.2.2-1: Receiver test ports

Conducted receive requirements are tested at the *TAB connector*, with the remaining receiver units(s) disabled or their *TAB connector(s)* being terminated.

C.2.3 Power supply options

If the *BS type 1-H* is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

C.3 BS with integrated Iuant BS modem

For the conducted tests in the present document, the integrated Iuant BS modem shall be switched off. Spurious emissions according to clauses 5.3.4 and 5.3.7 shall be measured only for frequencies above 20 MHz with the integrated Iuant BS modem switched on.

For the radiated tests in the present document, the integrated Iuant BS modem shall be switched off.

Annex D (normative): BS configurations for OTA testing

D.1 Transmit configurations

Radiated transmitter characteristics in clause 4 are specified at RIB, as shown in figure D.1-1, or at CLTA output, as shown in figure D.1-2, with a full complement of transceiver units for the configuration in normal operation.

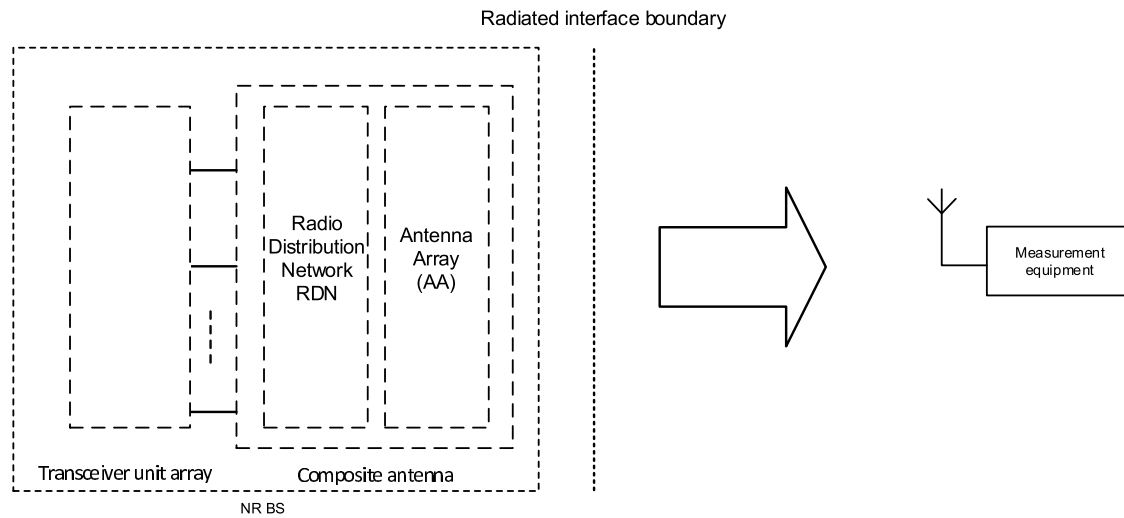


Figure D.1-1: Transmitter test interfaces

Top view

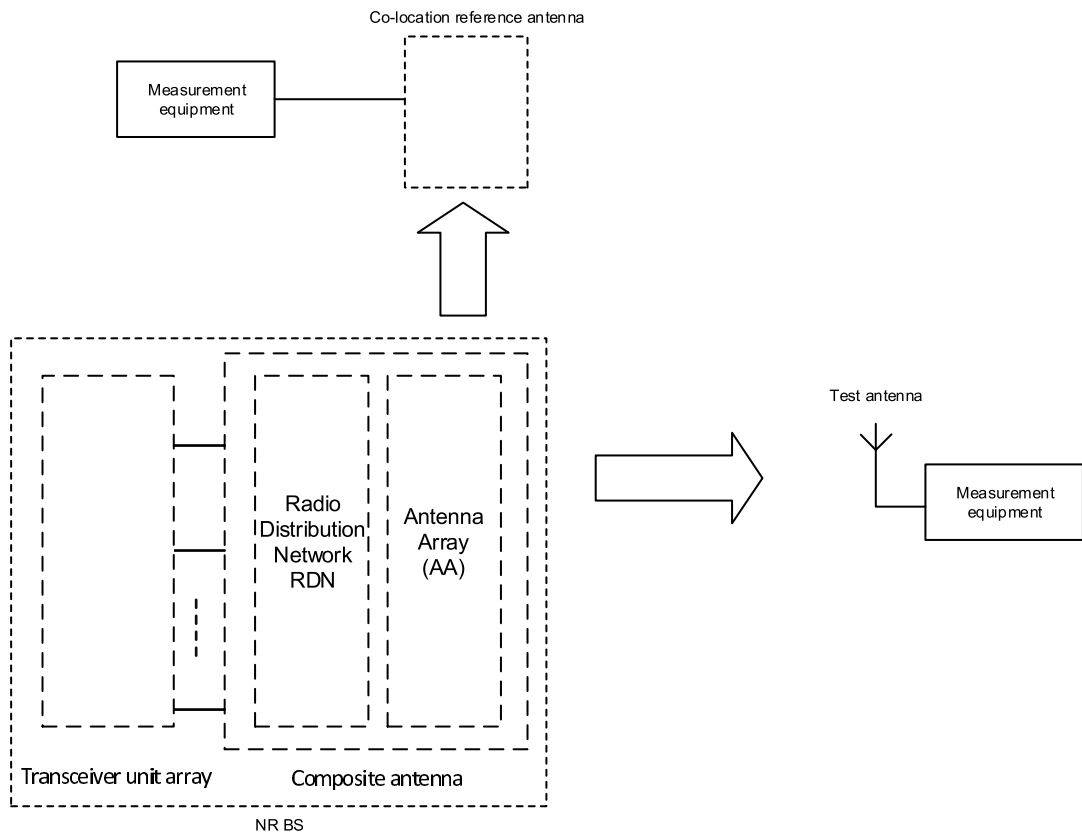


Figure D.1-2: Transmitter test interfaces for co-location concept

D.2 Receive configurations

The radiated receiver characteristics in clause 4 are specified at RIB, as shown in figure D.2-1, or at CLTA output, as shown in figure D.2-2, with a full complement of transceiver units for the configuration in normal operation.

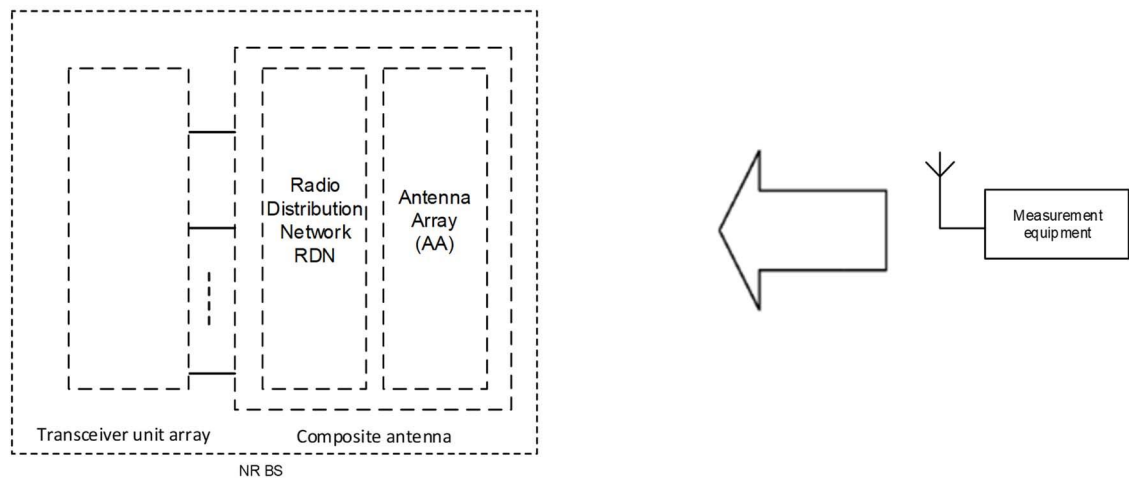


Figure D.2-1: Receiver test interfaces

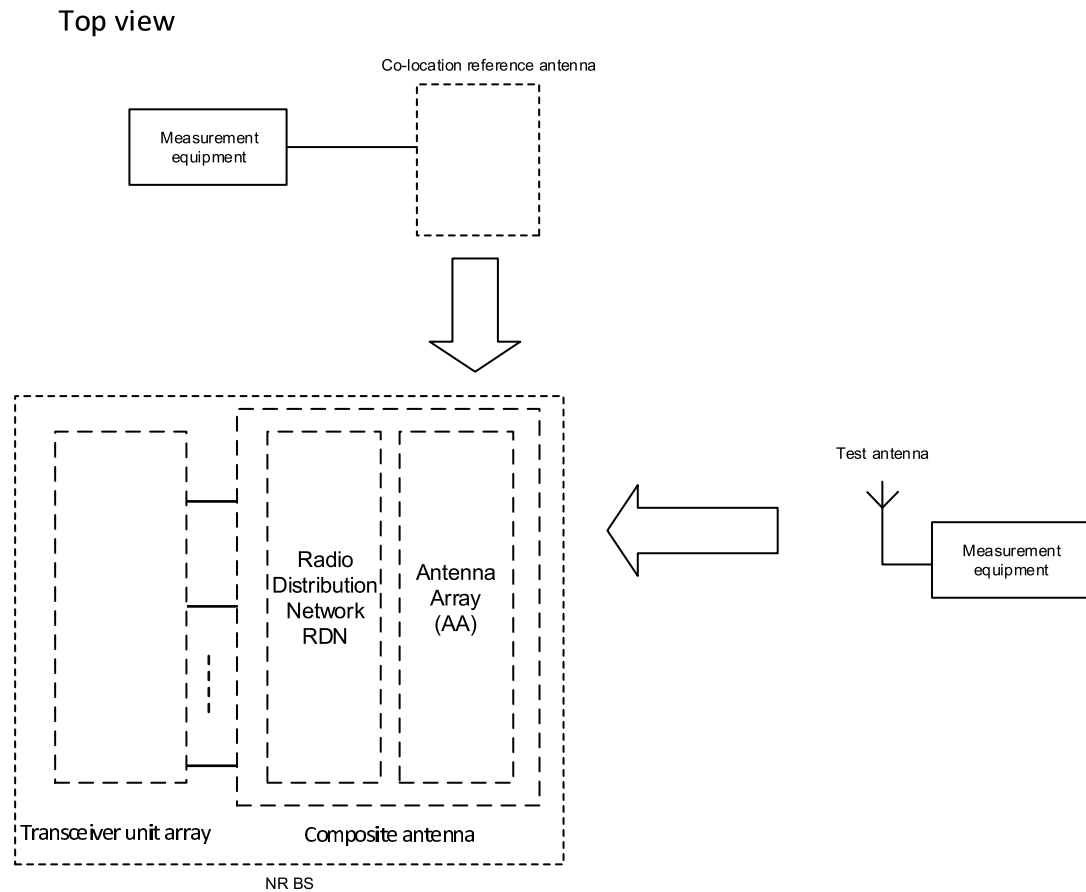


Figure D.2-2: Receiver test interfaces for co-location concept

D.3 Power supply options

If the BS is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

D.4 BS with integrated luant BS modem

For the tests in the present document, the integrated luant BS modem shall be switched off.

Annex E (informative): Checklist

This annex provides a traceability of the technical parameters for article 3.2 of Directive 2014/53/EU [i.2] defined in ETSI EG 203 336 [i.3] with the technical requirements for conformance defined in clause 4 of the present document.

If a technical parameter for article 3.2 of Directive 2014/53/EU [i.2] defined in ETSI EG 203 336 [i.3] has not been included in the present document, an explanation is provided. More details are included in ETSI TR 103 877 [i.29].

An explanation is also provided whenever a technical parameter defined in ETSI EG 203 336 [i.3] is covered by an alternative technical requirement.

Table E-1: Checklist

Technical Parameters defined in ETSI EG 203 336 [i.3]	Clauses of the present document	Comments
Transmitter Parameters		
Transmitter Spectrum mask	4.3.2	
Transmitter unwanted emissions in the out-of-band domain	4.3.3 4.3.13 4.3.14	
Transmitter unwanted emissions in the spurious domain	4.3.4 4.3.15	
Transmit power limits	N/A	See clause 4.2.2 in ETSI TR 103 877 [i.29].
Transmit power accuracy	4.3.5 4.3.16 4.3.17	
Transmitter Frequency stability	N/A	See clause 4.2.3 in ETSI TR 103 877 [i.29].
Transmitter Intermodulation attenuation	4.3.6 4.3.18	Not considered for FR2. See clause 4.2.4 in ETSI TR 103 877 [i.29].
Transmitter Time domain characteristics (e.g. the duty cycle, turn-on and turn-off, frequency hopping cycle, dynamic changes of modulation scheme and others)	N/A	See clause 4.2.5 in ETSI TR 103 877 [i.29].
Transmitter Transients	N/A	See clause 4.2.6 in ETSI TR 103 877 [i.29].
Receiver Parameters		
Receiver sensitivity	4.3.12 4.3.24 4.3.25	
Receiver co-channel rejection	N/A	See clause 4.2.7 in ETSI TR 103 877 [i.29].
Adjacent band/channel selectivity	4.3.11 4.3.23	
Spurious response rejection	N/A	See clause 4.2.8 in ETSI TR 103 877 [i.29].
Receiver blocking	4.3.8 4.3.9 4.3.20 4.3.21	
Receiver radio-frequency intermodulation	4.3.10 4.3.22	
Receiver unwanted emissions in the spurious domain	4.3.7 4.3.19	
Receiver dynamic range	N/A	See clause 4.2.9 in ETSI TR 103 877 [i.29].
Reciprocal mixing	N/A	See clause 4.2.9 in ETSI TR 103 877 [i.29].

Annex F (informative): Bibliography

- Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast). This one is Applicable from 20 April 2016 and repeals the Directive 2004/108/EC.
- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast) (LV Directive).
- Commission Decision (EU) 2018/661 of 28 April 2018 on the harmonisation of the 1 452-1 492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union.
- Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No1673/2006/EC of the European Parliament and of the Council.
- ECC Decision (16)02: "Harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems", Approved 17 June 2016.

Annex G (informative): Change History

Version	Information about changes
V15.1.1_0.0.1	First draft submitted at TFES #61
V15.1.1_0.0.2	Modified version of the first draft during TFES #61
V15.1.1_0.0.11	Implementation of latest CRs in RAN4, until August 2020
V15.1.1_0.0.12 to 16	Review during the MSG TFES #67 meeting and after
V15.1.1_0.0.17	Revision after ETSI Drafting team feedback and approved in remote consensus
V15.1.1_0.0.18	New revision for discussion at TFES #68
V15.1.1_0.0.19	New revision after decisions at TFES #68
V15.1.1_0.0.20	
V15.1.1_0.0.21	New revision. Correction on OBUE additional requirements and editorials
V15.1.1_0.0.22	New revision - many corrections, not only editorial
V15.1.1_0.0.22 to 26	Revision of bands tables 1-2 and 1-3 including references to EC/ECC decisions
V15.1.1_0.0.27	Revisions after HAS review – not final
V15.1.1_0.0.28 and 29	New final draft revised during TFES #72 meeting
V15.1.1_0.0.30 and 31	New final draft with revisions after TFES #72 meeting
V15.1.1_0.0.32	Added the annex on selection of parameters
V15.1.1_0.0.33	Approved as final draft at TFES #73
V15.1.1_0.0.34	Wording update of the note related to the applicability of EESS protection at MSG#67

History

Document history				
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