**3GPP TSG-RAN4 Meeting #106 *Revised R4-2301482***

**Athens, Greece, 27th Feb 2023 – 3rd March 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.108** | **CR** |  **0028** | **rev** | **1** | **Current version:** | **17.2.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | CR to TS 38.108: OBUE and open issues clarifications  |
|  |  |
| ***Source to WG:*** | Ericsson, Thales |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Core |  | ***Date:*** | 2023-02-27 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | It was agreed in RAN4#105 meeting (R4-2220291) to remove the ΔfOBUE concept and specify OBUE requirements based on BWSAN which had tobe defined then. This CR is introducing this new symbol, updating OBUE requirements accordingly and considering the various cases specific to SAN equipment.  |
|  |  |
| ***Summary of change:*** | Remove ΔfOBUE conceptIntroduceBWSAN concept and update impacted requirements accordingly.Clarify ACLR, OBUE and spurious requirements applicability. |
|  |  |
| ***Consequences if not approved:*** | The OBUE requirements won’t be correctly specified.The applicability of OBUE and spurious requirements will not be correct.Requirements applicability will remain unclear. |
|  |  |
| ***Clauses affected:*** | 3.1, 3.2, 3.3, 4.5, 4.6, 6.6.1, 6.6.3.2, 6.6.4.1, 6.6.4.2, 6.6.5.1, 6.6.5.2, 9.7.1, 9.7.4.2, 9.7.5.2.1,  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*<Start of the change>*

## 3.1 Definitions

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**basic limit:** emissions limit relating to the power supplied by a single transmitter to a single antenna transmission line in ITU-R SM.329 [2] used for the formulation of unwanted emission requirements for FR1.

**beam:** beam (of the antenna) is the main lobe of the radiation pattern of an *antenna array.*

NOTE: For certain *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:** direction where the maximum EIRP is found.

**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.

**Channel edge:** lowest or highest frequency of the NR carrier, separated by the *SAN channel bandwidth*.

**directional requirement:** requirement which is applied in a specific direction within the *OTA coverage range* for the Tx and when the AoA of the incident wave of a received signal is within the *OTA REFSENS RoAoA* or the *minSENS RoAoA* as appropriate for the receiver.

**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 (i.e. 0 dBi).

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

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

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

**feeder link:** Wireless link between satellite-Gateway and satellite.

**Geostationary Earth Orbit:** Circular orbit at 35,786 km above the Earth's equator and following the direction of the Earth's rotation. An object in such an orbit has an orbital period equal to the Earth's rotational period and thus appears motionless, at a fixed position in the sky, to ground observers.

**Low Earth Orbit:** Orbit around the Earth with an altitude between 300 km, and 1500 km.

**Highest Carrier:** The carrier with the highest carrier frequency transmitted/received in a specified frequency band.

**Lowest Carrier:** The carrier with the lowest carrier frequency transmitted/received in a specified frequency band.

**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 output power:** mean power level measured perRIB during the *transmitter ON period* for a specific carrier in a specified reference condition and corresponding to the declared *rated carrier TRP output* power (Prated,c,TRP).

**maximum total output power:** mean power level measured within the *operating band* at the indicated interface, during the *transmitter ON period* in a specified reference condition.

**maximum total TRP output power:** mean power level measured perRIB during the *transmitter ON period* in a specified reference condition and corresponding to the declared *rated total TRP output* power (Prated,t,TRP).

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

**minSENS:** the lowest declared EIS value for the OSDD's declared for OTA sensitivity requirement.

**minSENS RoAoA:** The *reference RoAoA* associated with the OSDD with the lowest declared EIS.

**minimum elevation angle**: Minimum angle under which the satellite can be seen by a UE.

**non-terrestrial networks:** Networks, or segments of networks, using an airborne or space-borne vehicle to embark a transmission equipment relay node or SAN.

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

NOTE: The *operating band*(s) for a SAN is declared by the manufacturer according to the designations in tables 5.2-1 and 5.2-2.

**OTA coverage range**: a 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:** the RoAoA determined by the contour defined by the points at which the achieved EIS is 3dB higher than the achieved EIS in the reference direction assuming that for any AoA, the receiver gain is optimized for that AoA.

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

**OTA sensitivity directions declaration:** set of manufacturer declarations comprising at least one set of declared minimum EIS values (with *SAN 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.

**Radio Bandwidth:** frequency difference between the upper edge of the highest used carrier and the lower edge of the lowest used carrier.

**rated beam EIRP:** For a declared beam and *beam direction pair*, the *rated beam EIRP* level is the maximum power that the SAN is declared 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 output power:** mean power level declared by the manufacturer per carrier, for SAN 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 total TRP output power:** mean power level declared by the manufacturer, that the manufacturer has declared to be available at the RIB during the *transmitter ON period.*

**reference beam direction pair:** declared *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.*

**receiver target:** AoA in which reception is performedby *SAN types 1-H* or *SAN type 1-O.*

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

**receiver target reference direction:** direction inside the *OTA sensitivity directions declaration* declared by the manufacturer for conformance testing. For an OSDD without *receiver target redirection range*, this is a direction inside the *sensitivity RoAoA.*

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

**requirement set:** one of the NR SAN requirement's set as defined for *SAN type 1-H*, *SAN type 1-O.*

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

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

NOTE 2: It is possible for the SAN to transmit to and/or receive from one or more satellite UE bandwidth parts that are smaller than or equal to the *SAN transmission bandwidth configuration*, in any part of the *SAN transmission bandwidth configuration*.

**SAN RF Bandwidth**: RF bandwidth in which a SAN transmits and/or receives single or multiple carrier(s) within a supported *operating band.*

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

**SAN RF Bandwidth edge:** frequency of one of the edges of the *SAN RF Bandwidth*.

**SAN transmission bandwidth configuration**: set of resource blocks located within the *SAN channel bandwidth* which may be used for transmitting or receiving by the SAN.

**SAN type 1-H:** Satellite Access Node operating at FR1 with a requirement set consisting of conducted requirements defined at individual *TAB connectors* and OTA requirements defined at RIB.

**SAN type 1-O:** Satellite Access Node operating at FR1 with a requirement set consisting only of OTA requirements defined at the RIB.**SAN total assigned bandwidth:** Bandwidth of the total assigned band (frequencies range) as defined in SM.1541-6

**SAN transponder bandwidth:** Total bandwidth of the carrier(s) in operation by one SAN transponder.

NOTE: When the SAN transponder operates one carrier only, the SAN transponder bandwidth is equal to the SAN channel bandwidth of this carrier.

**SAN transponder:** part of the SAN permitting to receive, channelize and transmit signals within an allocated bandwidth.

**satellite:** A space-borne vehicle embarking a bent pipe payload or a regenerative payload telecommunication transmitter, placed into Low-Earth Orbit (LEO) or Geostationary Earth Orbit (GEO).

**Satellite Access Node (SAN)**: node providing NR user plane and control plane protocol terminations towards NTN Satellite capable UE, and connected via the NG interface to the 5GC. It encompass a transparent NTN payload on board a NTN platform, a gateway and gNB functions.

**satellite-gateway:** An earth station or gateway is located at the surface of Earth, and providing sufficient RF power and RF sensitivity for accessing to the satellite.

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

**TAB connector:** *transceiver array boundary* connector.

**total radiated power:** is the 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 satellite UE or SAN, measured in resource block units.

## 3.2 Symbols

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

 Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel.

BeWθ,REFSENS Beamwidth equivalent to the *OTA REFSENS RoAoA* in the θ-axis in degrees. Applicable for FR1 only.

BeWφ,REFSENS Beamwidth equivalent to the *OTA REFSENS RoAoA* in the φ-axis in degrees. Applicable for FR1 only.

BWChannel *SAN channel bandwidth.*

BWConfig *Transmission bandwidth configuration*, where BWConfig = *N*RB x SCS x 12.

BWGB,low The minimum guard band defined in clause 5.3.3 for lowest assigned component carrier.

BWGB,high The minimum guard band defined in clause 5.3.3 for highest assigned component carrier.

BWSAN The *SAN transponder bandwidth*Δf Separation between the *channel edge* frequency and the nominal -3 dB point of the measuring filter closest to the carrier frequency.

ΔFGlobal Global frequency raster granularity.

Δfmax f\_offsetmax minus half of the bandwidth of the measuring filter.

ΔfOOB Maximum offset of the out-of-band boundary from the uplink *operating band* edge.

ΔminSENS Difference between conducted reference sensitivity and minSENS.

ΔOTAREFSENS Difference between conducted reference sensitivity and OTA REFSENS.

ΔFRaster Channel raster granularity.

EISminSENS The EIS declared for the *minSENS RoAoA.*

EISREFSENS OTA REFSENS EIS value.

FC *RF reference frequency* on the channel raster, given in table 5.4.2.2-1.

FC,low The Fc of the *lowest carrier*, expressed in MHz.

FC,high The Fc of the *highest carrier*, expressed in MHz.

FDL,low The lowest frequency of the downlink *operating band.*

FDL,high The highest frequency of the downlink *operating band.*

Ffilter Filter centre frequency.

Foffset,high Frequency offset from FC,high to the upper *SAN RF Bandwidth edge.*

Foffset,low Frequency offset from FC,low to the lower *SAN RF Bandwidth edge.*

f\_offset Separation between the *channel edge* frequency and the centre of the measuring.

f\_offsetmax The offset to the frequency ΔfOBUE outside the downlink *operating band.*

FREF RF reference frequency.

FREF-Offs Offset used for calculating FREF.

FUL,low The lowest frequency of the uplink *operating band.*

FUL,high The highest frequency of the uplink *operating band.*

GBChannel Minimum guard band defined in clause 5.3.3.

 Physical resource block number.

NRB *Transmission bandwidth configuration*, expressed in resource blocks.

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN).

NREF-Offs Offset used for calculating NREF scaling per cell, as calculated in clause 6.1.

PEIRP,N EIRP level for channel N.

Pmax,c,AC*Maximum carrier output power* measuredper *antenna connector.*

Pmax,c,TABC The *maximum carrier output power per TAB connector.*

Pmax,c**,**TRP*Maximum carrier TRP output power* measuredat the RIB(s), and corresponding to the declared *rated carrier TRP output power* (Prated,c,TRP).

Pmax,c,EIRP The maximum carrier EIRPwhen the SAN is configured at the maximum rated carrier output TRP (Prated,c,TRP).

Prated,c,sys Prated,c,sys,GEO for SAN GEO class or Prated,c,sys,LEO for SAN LEO class.

Prated,c,TRP *Rated carrier TRP output power* declaredper RIB

Prated,c,sys,GEO The sum of Prated,c,TABC for all *TAB connectors* for a single carrier of the SAN GEO class.

Prated,c,sys,LEO The sum of Prated,c,TABC for all *TAB connectors* for a single carrier of the SAN LEO class.

Prated,c,TABC Prated,c,TABC,GEO for SAN GEO class or Prated,c,TABC,LEO for SAN LEO class.

Prated,c,TABC,GEO The *rated carrier output power per TAB connector* of the SAN GEO class*.*

Prated,c,TABC,LEO The *rated carrier output power per TAB connector* of the SAN LEO class*.*

Prated,c,TRP *Rated carrier TRP output power* declaredper RIB.

Prated,t,TRP *Rated total TRP output power* declaredper RIB.

PREFSENS Conducted Reference Sensitivity power level.

SSREF SS block reference frequency position.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AA Antenna Array

AAS Active Antenna System

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

AoA Angle of Arrival

AWGN Additive White Gaussian Noise

BW Bandwidth

CA Carrier Aggregation

CP-OFDM Cyclic Prefix-OFDM

CW Continuous Wave

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DM-RS Demodulation Reference Signal

EIRP Equivalent Isotropic Radiated Power

EIS Equivalent Isotropic Sensitivity

EVM Error Vector Magnitude

FR Frequency Range

FRC Fixed Reference Channel

GEO Geostationary Earth Orbiting

GSCN Global Synchronization Channel Number

ICS In-Channel Selectivity

LEO Low Earth Orbiting

MCS Modulation and Coding Scheme

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

NTN Non-Terrestrial Network

OOB Out-of-band

OOBE Out-of-band Emissions

OSDD OTA Sensitivity Directions Declaration

OTA Over-The-Air

PRB Physical Resource Block

PT-RS Phase Tracking Reference Signal

QAM Quadrature Amplitude Modulation

RB Resource Block

RDN Radio Distribution Network

RE Resource Element

REFSENS Reference Sensitivity

RF Radio Frequency

RIB Radiated Interface Boundary

RMS Root Mean Square (value)

RoAoA Range of Angles of Arrival

RX Receiver

SAN Satellite Access Node

SCS Sub-Carrier Spacing

SSB Synchronization Signal Block

TAB Transceiver Array Boundary

TRP Total Radiated Power

TX Transmitter

*<End of the change>*

*<Start of the change>*

## 4.5 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements, or as mandatory requirements set by local and regional regulation. It is normally not stated in the 3GPP specifications under what exact circumstances the regional requirements apply, since this is defined by local or regional regulation.

Table 4.5-1 lists all requirements in the present specification that may be applied differently in different regions.

Table 4.5-1: List of regional requirements

| Clause number | Requirement | Comments |
| --- | --- | --- |
| 5.2 | *Operating bands* | Satellite *operating bands* may be applied regionally. |
| 6.6.4,9.7 | Out-of-band emission,OTA unwanted emissions | For n255 operation in US, Limits in FCC Title 47 apply. |
| 6.6.5 | Tx spurious emissions,OTA Tx spurious emissions | For n255 operation in US, Limits in FCC Title 47 apply. |

## 4.6 Applicability of minimum requirements

In table 4.6-1, the requirement applicability for each *requirement set* is defined. For each requirement, the applicable requirement clause in the specification is identified. Requirements not included in a *requirement set* is marked not applicable (NA).

Table 4.6-1: Requirement set applicability

|  |  |
| --- | --- |
| Requirement | Requirement set |
|  | *SAN type 1-H* | *SAN type 1-O* |
| Satellite Access Network output power | 6.2 |  |
| Output power dynamics  | 6.3 |  |
| Transmit ON/OFF power  | NA |  |
| Frequency error | 6.5.1 |  |
| Modulation quality | 6.5.2 |  |
| Time alignment error | NA |  |
| Occupied bandwidth | 6.6.2 |  |
| ACLR | 6.6.3 |  |
| Out-of-band emissions | 6.6.4 |  |
| Transmitter spurious emissions | 6.6.5 |  |
| Transmitter intermodulation  | NA | NA |
| Reference sensitivity level | 7.2 |  |
| Dynamic range  | 7.3 |  |
| ACS  | 7.4.1 |  |
| In-band blocking  | NA |  |
| Out-of-band blocking  | 7.5 |  |
| Receiver spurious emissions  | NA |  |
| Receiver intermodulation | NA |  |
| In-channel selectivity  | 7.8 |  |
| Performance requirements | 8 |  |
| Radiated transmit power | 9.2 | 9.2 |
| OTA Satellite Access Network output power |  | 9.3 |
| OTA output power dynamics |  | 9.4 |
| OTA transmit ON/OFF power |  | NA |
| OTA frequency error |  | 9.6.1 |
| OTA modulation quality |  | 9.6.2 |
| OTA time alignment error |  | NA |
| OTA occupied bandwidth |  | 9.7.2 |
| OTA ACLR | NA | 9.7.3 |
| OTA out-of-band emission |  | 9.7.4 |
| OTA transmitter spurious emission  |  | 9.7.5 |
| OTA transmitter intermodulation  |  | NA |
| OTA sensitivity | 10.2 | 10.2 |
| OTA reference sensitivity level |  | 10.3 |
| OTA dynamic range |  | 10.4 |
| OTA ACS |  | 10.5.1 |
| OTA in-band blocking |  | NA |
| OTA out-of-band blocking | NA | 10.6 |
| OTA receiver spurious emission  |  | NA |
| OTA receiver intermodulation |  | NA |
| OTA in-channel selectivity |  | 10.9 |
| Radiated performance requirements |  | 11 |

NOTE: Co-location requirements are not applicable to SAN.

*<End of the change>*

*<Start of the change>*

### 6.6.1 General

Unwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions [2]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *SAN 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 SAN transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and out-of-band emissions (OOBE).

Table 6.6.1-1: void

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |

For *SAN type 1-H* the unwanted emission requirements are applied per the *TAB connector TX min cell groups* for all the configurations supported by the SAN.

There is in addition a requirement for occupied bandwidth.

*<End of the change>*

*<Start of the change>*

### 6.6.3 Adjacent Channel Leakage Power Ratio

#### 6.6.3.1 General

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

#### 6.6.3.2 Minimum requirement for *SAN type 1-H*

The ACLR is defined with a square filter of bandwidth equal to the transmission bandwidth configuration of the transmitted signal (BWConfig) centred on the assigned channel frequency and a filter centred on the adjacent channel frequency according to the tables below.

The ACLR shall be higher than the value specified in Table 6.6.3.2-1/2.

Table 6.6.3.2-1: SAN ACLR limit for GEO class

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SAN channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz) | SAN 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 corresponding filter bandwidth | ACLR limit |
| 5, 10, 15, 20 | BWChannel | NR of same BW (NOTE 2) | Square (BWConfig) (NOTE 1) | 14 |
|  | 2 x BWChannel | NR of same BW (NOTE 2) | Square (BWConfig) (NOTE 1) | 14 |
| NOTE 1: BWChannel and BWConfig are the *SAN channel bandwidth* and *transmission bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig). |

Table 6.6.3.2-2: SAN ACLR limit for LEO class

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SAN channel bandwidth of lowest/highest carrier transmitted BWChannel (MHz) | SAN 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 corresponding filter bandwidth | ACLR limit |
| 5, 10, 15, 20 | BWChannel | NR of same BW (NOTE 2) | Square (BWConfig)(NOTE 1) | 24 |
|  | 2 x BWChannel | NR of same BW (NOTE 2) | Square (BWConfig) (NOTE 1) | 24 |
| NOTE 1: BWChannel and BWConfig are the *SAN channel bandwidth* and *transmission bandwidth configuration* of the *lowest/highest carrier* transmitted on the assigned channel frequency.NOTE 2: With SCS that provides largest transmission bandwidth configuration (BWConfig). |

*<End of the change>*

*<Start of the change>*

### 6.6.4 Out-of-band emissions

#### 6.6.4.1 General

Unless otherwise stated, the out-of-band emission (OOBE) limits for SAN in FR1 are defined from BWSAN channel edge up to frequencies separated from the BWSAN channel edge by 200% of the necessary bandwidth.

The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer’s specification.

*Basic limits* are specified in the tables below, where:

- Δf is the separation between the BWSAN *channel edge* frequency and the nominal -3dB 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.

- PSDChannel [dBm/4kHz] represents the Power Spectral Density of the channel(s) operating in BWSAN.

- BWSAN [MHz] is the considered SAN transponder bandwidth.

- is the *SAN class parameter* in dB identified to characterize different SAN classes.

6.6.4.2 Minimum requirements for *SAN type 1-H*

For SAN operating in Bands n256, n255, the requirements are specified in table 6.6.4.2-1 for GEO and LEO class respectively, in line with Annex 5 of ITU recommendation SM.1541-6 [9].

The SAN out-of-band (OOBE) requirements for GEO and LEO classes are therefore defined as described in Table 6.6.4.2‑1 below.

Table 6.6.4.2-1: SAN LEO and GEO Classes OBUE basic limits

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Basic limits(dBm) | Measurement bandwidth |
| 0 MHz ≤ Δf < 2× BWSAN | 0.002 MHz ≤ f\_offset < 2× BWSAN + 0.002 MHz |  | 4 kHz |
| NOTE 1: PSDChannel = Prated,c,sys – 10log10(BWSAN) – 24, unit dBm/4kHz.NOTE 2: SE limit is spurious emission limit specified in spurious emission clause 6.6.5.NOTE 3: PSD attenuation as in ITU-R SM.1541-6 [9], Annex 5 OoB domain emission limits for space services.NOTE 4: =0 dB for GEO class and =3 dB for LEO class. |

*<End of the change>*

*<Start of the change>*

### 6.6.5 Transmitter spurious emissions

#### 6.6.5.1 General

The transmitter spurious emission limits shall apply from 30 MHz to the fifth harmonic of the upper frequency edge of the DL operating band, excluding the *SAN transponder bandwidth* BWSAN and the frequency range where the out-of-band emissions apply. For some *operating bands*, the upper limit is higher than 12.75 GHz in order to comply with the 5th harmonic limit of the downlink *operating band*, as specified in ITU-R recommendation SM.329 [2].

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.

Unless otherwise stated, all requirements are measured as mean power (RMS).

#### 6.6.5.2 Minimum requirements for *SAN type 1-H*

##### 6.6.5.2.1 General transmitter spurious emissions requirements

The requirements in table 6.6.5.2.1-1 shall apply. The application of those limits shall be the same as for out-of-band emissions in clause 6.6.4.

Table 6.6.5.2.1-1: General SAN transmitter spurious emission limits in FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Spurious frequency range | Prated,c,sys(dBm) | Basic limit(dBm) | Measurement bandwidth(kHz) | Notes |
| 30 MHz – 5th harmonic of the upper frequency edge of the DL operating band | ≤ 47 | -13 | 4 | NOTE 1, NOTE 2, NOTE 3 |
|  | > 47 | Prated,c,sys – 60dB |  |  |
| NOTE 1: *Measurement bandwidth*s as in ITU-R SM.329 [2], s4.1.NOTE 2: Upper frequency as in ITU-R SM.329 [2], s2.5 table 1.NOTE 3: The lower frequency limit is replaced by 0.7 times the waveguide cut-off frequency, according to ITU-R SM.329 [2], for systems having an integral antenna incorporating a waveguide section, or with an antenna connection in such form, and of unperturbed length equal to at least twice the cut-off. |

*<End of the change>*

*<Start of the change>*

### 9.7.1 General

Unwanted emissions consist of so-called out-of-band emissions and spurious emissions according to ITU definitions ITU-R SM.329 [2]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *SAN 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 *SAN type 1-O* is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and out-of-band (OOBE).

The unwanted emission requirements are applied per cell for all the configurations. Requirements for OTA unwanted emissions are captured as TRP requirements or *directional requirements*, as described per requirement.

There is in addition a requirement for occupied bandwidth.

*<End of the change>*

*<Start of the change>*

### 9.7.4 OTA out-of-band emissions

#### 9.7.4.1 General

The OTA limits for out-of-band emissions are specified as TRP per RIB unless otherwise stated.

#### 9.7.4.2 Minimum requirement for *SAN type 1-O*

Out-of-band emissions in FR1 are limited by OTA out-of-band emission limits. Unless otherwise stated, the out-of-band emission limits in FR1 are defined from channel edge up to frequencies separated from the channel edge by 200% of the necessary bandwidth.

For a SAN operating multiple transponders over the *SAN total assigned bandwidth* in the same service area, the definitions above apply to the lower edge of the transponder operating at the lowest frequencies and the upper edge of the transponder operating at the highest frequencies.

For a SAN operating multiple transponders in the same service area, the operating band unwanted emissions limits don’t apply in the necessary bandwidth of the other transponder(s), as mentioned in Annex 5 of SM.1541-6 [9].The requirements shall apply whatever the type of transmitter considered and for all transmission modes foreseen by the manufacturer's specification. For a RIB operating in multi-carrier, the requirements apply to SAN channel bandwidths of the outermost carrier for the frequency ranges defined in clause 6.6.4.1.

The OTA out-of-band requirement for SAN type 1-O shall not exceed each applicable limit in clause 6.6.4.2.

*<End of the change>*

*<Start of the change>*

### 9.7.5 OTA transmitter spurious emissions

#### 9.7.5.1 General

Unless otherwise stated, all requirements are measured as mean power.

The OTA spurious emissions limits are specified as TRP per RIB unless otherwise stated.

#### 9.7.5.2 Minimum requirement for *SAN type 1-O*

##### 9.7.5.2.1 General

The OTA transmitter spurious emission limits for FR1 shall apply from 30 MHz to the 5th harmonic of the upper frequency edge of the DL operating band, excluding the *SAN transponder bandwidth* BWSAN and the frequency range where the out-of-band emissions apply.

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.

*<End of the change>*