**3GPP TSG- Meeting #**

**, , -**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | (NR\_NTN\_solutions-Core) CR for TS 38.108 to update NTN frequency range (R18) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *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 can be 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:*** | | In the WF R4-2305925, RAN4 has agreed to update the following NTN frequency range for both TS 38.101-5 and TS 38.108.   |  |  | | --- | --- | | Frequency range designation | Corresponding frequency range | | FR1-NTN1 | 410 MHz – 7125 MHz | | FR2-NTN2 | 17300 MHz – 30000 MHz | | NOTE 1: [NTN bands within this frequency range are regarded as a FR1 band when references from other specifications.]  NOTE 2: [NTN bands within this frequency range are regarded as a FR2 band when references from other specifications.] | | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To introduce NTN suffix for NTN frequency range definition. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Current NTN frequency range definition in TS 38.108 is not aligned with the latest RAN4’s agreement in WF R4-2305925. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 3.2, 6.6.4.1, 6.6.5.2.1, 7.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 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-NTN.

**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.

**Enhanced channel raster**: channel raster with a 10 kHz granularity in bands with a 100 kHz channel raster.

**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.

**necessary bandwidth:** The width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

**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-NTN 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-NTN 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**: 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-NTN only.

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

 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,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,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,TABC The *rated total output power* declared at *TAB connector*.

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

Prated,t,sys The sum of Prated,t,TABC for all *TAB connectors*.

PREFSENS Conducted Reference Sensitivity power level.

SSREF SS block reference frequency position.

## **<<Next of Change>>**

#### 6.6.4.1 General

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

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.

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

## **<<Next of Change>>**

##### 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-NTN

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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. | | | | |

## **<<Next of Change>>**

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

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 7.2.2-1 and 7.2.2-2 for *SAN type 1-H* in all operating band in FR1-NTN.

Table 7.2.2-1: SAN GEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel  (NOTE) | Reference sensitivity power level, PREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 | -99.3 |
| 10, 15 | 30 | G-FR1-A1-2 | -99.4 |
| 10, 15 | 60 | G-FR1-A1-3 | -96.5 |
| 20 | 15 | G-FR1-A1-4 | -92.9 |
| 20 | 30 | G-FR1-A1-5 | -93.2 |
| 20 | 60 | G-FR1-A1-6 | -93.3 |
| NOTE: PREFSENS 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 *SAN channel bandwidth*. | | | |

Table 7.2.2-2: SAN LEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel  (NOTE) | Reference sensitivity power level, PREFSENS  (dBm) |
| 5, 10, 15 | 15 | G-FR1-A1-1 | -102.4 |
| 10, 15 | 30 | G-FR1-A1-2 | -102.5 |
| 10, 15 | 60 | G-FR1-A1-3 | -99.6 |
| 20 | 15 | G-FR1-A1-4 | -96.0 |
| 20 | 30 | G-FR1-A1-5 | -96.3 |
| 20 | 60 | G-FR1-A1-6 | -96.4 |
| NOTE: PREFSENS 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 *SAN channel bandwidth*. | | | |

## **<<End of Change>>**