**3GPP TSG-WG4 Meeting #109** [**R4-2320903**](file:///D:\RAN4%23108bis\Docs\R4-2317653.zip)

**Chicago, USA, 13th of November – 17th of November, 2023**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-5** | **CR** | **0053** | **rev** | **0** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Draft CR to TS 38.101-5: NTN UE in Ka-band | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | THALES | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_enh-Core | | | | |  | ***Date:*** | | | 2023-11-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | 8 |
|  | *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:*** | | To introduce the NTN UE in Ka-band into TS 38.101-5 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To introduce the NTN UE in Ka-band into TS 38.101-5 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Requirements for NTN UE in Ka-band are missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 9.4, 9.5.1, 9.5.2, 9.5.3, 9.5.4, 9.5.5 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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>**

## 9.4 Transmitter signal quality

9.4.1 Frequency Error

The NTN satellite VSAT UE basic measurement interval of modulated carrier frequency is 1 UL slot. The NTN satellite VSAT UE pre-compensates the uplink modulated carrier frequency by the estimated Doppler shift according to 3GPP TS 38.300 [9] clause 16.14.2. The mean value of basic measurements of NTN VSAT UE modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to ideally pre-compensated reference uplink carrier frequency.

[NOTE: The ideally pre-compensated reference uplink carrier frequency consists of the UL carrier frequency signalled to the VSAT UE by SAN and UL pre-compensated Doppler frequency shift. For the test case, the location of the VSAT UE is explicitly provided to the VSAT UE from the test equipment.]

Requirement will be verified for at least two cases of which one has zero Doppler conditions.

The frequency error is defined as a directional requirement. The requirement is verified in beam locked mode with the test metric of Frequency (Link=TX beam peak direction, Meas=Link angle).

9.4.2 Transmit modulation quality

The requirements for transmit modulation quality defined in 3GPP TS 38.101-2 [x] clause 6.4.2 shall apply for NTN satellite VSAT UE.

## 9.5 Output RF spectrum emissions

### ~~9.5.1 General~~

### 9.5.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 9.5.1-1.

The occupied bandwidth is defined as a directional requirement. The requirement is verified in beam locked mode with the test metric of OBW (Link=TX beam peak direction, Meas=Link angle).

**Table 9.5.1-1: Occupied channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Occupied channel bandwidth / Channel bandwidth** | | | |
|  | **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** |
| **Channel bandwidth (MHz)** | 50 | 100 | 200 | 400 |

### ~~9.5.3 ACLR~~

### 9.5.2 Out of Band Emissions

9.5.2.1 General

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an adjacent channel leakage power ratio. Additional requirements to protect specific bands are also considered.

The requirements in clause 9.5.2.2 only apply when both UL and DL of a VSAT UE are configured for single CC operation, and they are of the same bandwidth.

All out of band emissions for NTN-FR2 are TRP.

9.5.2.2 Spectrum emission mask

The spectrum emission mask of the VSAT UE applies to frequencies (ΔfOOB) starting from the ± edge of the assigned NR channel bandwidth. For frequencies offset greater than FOOB as specified in Table 9.5.2.2-1 the spurious requirements in clause 9.5.3 are applicable.

The power of any UE emission shall not exceed the levels specified in Table 9.5.2.2-1 for the specified channel bandwidth. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

**Table 9.5.2.2-1: General NR spectrum emission mask for NTN-FR2.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Spectrum emission limit (dBm) / Channel bandwidth** | | | | |
| **ΔfOOB**  **(MHz)** | **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** | **Measurement bandwidth** |
| ± 0-5 | -5 | -5 | -5 | -5 | 1 MHz |
| ± 5-10 | -13 | -5 | -5 | -5 | 1 MHz |
| ± 10-20 | -13 | -13 | -5 | -5 | 1 MHz |
| ± 20-40 | -13 | -13 | -13 | -5 | 1 MHz |
| ± 40-80 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 80-100 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 100-160 |  | -13 | -13 | -13 | 1 MHz |
| ± 160-200 |  | -13 | -13 | -13 | 1 MHz |
| ± 200-400 |  |  | -13 | -13 | 1 MHz |
| ± 400-800 |  |  |  | -13 | 1 MHz |
| ± 800-1600 |  |  |  |  | 1 MHz |
| ± 1600-3200 |  |  |  |  | 1 MHz |
| ± 3200-4000 |  |  |  |  | 1 MHz |
| NOTE 1: Void | | | | | |

9.5.2.3 Adjacent channel leakage ratio

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. ACLR requirement is specified for a scenario in which adjacent carrier is another NRchannel.

NR Adjacent Channel Leakage power Ratio (NRACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 9.5.2.3-1 for NTN-FR2.

If the measured adjacent channel power is greater than –35 dBm then the NRACLR shall be higher than the value specified in Table 9.5.2.3-1. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

**Table 9.5.2.3-1: General requirements for NRACLR for NTN-FR2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Channel bandwidth / NRACLR / Measurement bandwidth** | | | |
| **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** |
| NRACLR for band n512, n511, n510 | [x] dB | [x] dB | [x] dB | [x] dB |
| NR channel measurement bandwidth (MHz) | 47.58 | 95.16 | 190.20 | 380.28 |
| Adjacent channel centre frequency offset (MHz) | +50  /  -50 | +100  /  -100 | +200  /  -200 | +400  /  -400 |

### 9.5.3 Spurious Emissions

~~Please add the generic spurious emission in this part.~~

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements in line with SM.329 [x] and NR operating band requirement to address UE co-existence. Spurious emissions are measured as TRP.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 9.5.3-1 starting from the edge of the assigned NR channel bandwidth. The spurious emission limits in Table 9.5.3-2 apply for all transmitter band configurations (NRB) and channel bandwidths. The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

**Table 9.5.3-1: Boundary between NR out of band and spurious emission domain**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel bandwidth** | **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** |
| OOB boundary FOOB (MHz) | 100 | 200 | 400 | 800 |

**Table 9.5.3-2: Spurious emissions limits**

|  |  |  |
| --- | --- | --- |
| **Frequency Range** | **Maximum Level** | **Measurement bandwidth** |
| 30 MHz ≤ f < 1000 MHz | -36 dBm | 100 kHz |
| 1 GHz ≤ f < 12.75 GHz | -30 dBm | 1 MHz |
| 12.75 GHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band in GHz | -13 dBm | 1 MHz |

#### 9.5.3.1 On-axis spurious requirement

##### 9.5.3.1.1 Minimum requirement for Mobile VSAT

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement | Note |
| n512 | EN 303 978 Clause 4.2.2 |  |
| n511 | FCC |  |
| n510 |  |  |

##### 9.5.3.1.2 Minimum requirement for Fixed VSAT.

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement |  |
| n512 | EN 301 360 Clause 4.2.3 |  |
| n511 | FCC |  |
| n510 |  |  |

#### 9.5.3.2 Off-axis spurious requirement

##### 9.5.3.2.1 Minimum requirement for Mobile VSAT

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement | Note |
| n512 | EN 303 978 Clause 4.2.1 |  |
| n511 | FCC |  |
| n510 |  |  |

##### 9.5.3.2.2 Minimum requirement for Fixed VSAT

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement |  |
| n512 | EN 301 360 Clause 4.2.2 |  |
| n511 | FCC |  |
| n510 |  |  |

### 9.6 Antenna point accuracy

#### 9.6.1 Minimum requirement for Mobile VSAT

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement | Note |
| n512 | EN 303 978, manufacturer declaration based, and On-axis cross polarization isolation specification |  |
| n511 | FCC |  |
| n510 |  |  |

#### 9.6.2 Minimum requirement for Fixed VSAT

|  |  |  |
| --- | --- | --- |
| Applicable band | Minimum requirement |  |
| n512 | EN 301 360 Clause 4.2.6 |  |
| n511 | FCC |  |
| n510 |  |  |

# 10 Radiated receiver characteristics

## 10.1 General

## 10.2 Diversity characteristics

2Rx

## 10.3 Reference sensitivity

### 10.3.1 General

#### 10.3.2.1 Reference sensitivity power level for Mobile VSAT

|  |  |  |
| --- | --- | --- |
|  | EIS |  |
| Class 1 | XX NF=2.5dB |  |
| Class 2 | XX NF=6dB |  |

#### 10.3.2.2 Reference sensitivity power level for Fixed VSAT

|  |  |  |
| --- | --- | --- |
|  | EIS |  |
| Class 1 | XX NF=2.5dB |  |
| Class 2 | XX NF=6dB |  |

## 

## 10.4 Maximum input level

### 10.4.1 Minimum requirement for Mobile VSAT

### 10.4.2 Minimum requirement for Fixed VSAT

## 10.5 Adjacent channel selectivity

### 10.5.1 Minimum requirement for Mobile VSAT

### 10.5.2 Minimum requirement for Fixed VSAT

## Annex D for antenna modelling for NTN VSAT