**3GPP TSG-RAN WG4 Meeting # 116 *R4-2510859***

**Bengaluru, India, 25th – 29th August, 2025**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.863** | **CR** | **0037** | **rev** | **-** | **Current version:** | **19.0.1** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Formal BigCR to TR 38.863 for NTN HPUE | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung, Apple, CATT, China Telecom, CSCN, Echostar, Ericsson, Globalstar, Hisilicon, Huawei, Inmarsat, LG Electronics, MediaTek Inc., Nokia, OPPO, Qualcomm Incorporated, Skyworks Solutions Inc., THALES, ViaSat, vivo, Xiaomi, ZTE Corporation | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IoT\_NTN\_req\_test\_enh-Core | | | | |  | ***Date:*** | | | 2025-08-15 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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:*** | | Introduce and document the Release 19 RAN4 NTN HPUE studies and discussions to TR 38.863. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To include following endorsed draft CRs:   * R4-2508069, to add new section 6b to describe NTN HPUE coex study assumption, results and conclusions, and to amend new Annex F. * R4-2511791, to introduce general part and conducted MOP for NTN supporting HPUE. * R4-2508071, to add the agreed ACLR requirements, noting that PC1.5 related contents are removed based on agreement from R4-2511793 * R4-2508072, to add RSD requirements, noting that PC1.5 related contents are removed based on agreement from R4-2511793 * R4-2512822, to include A-MPR analysis for n255; * R4-2512823, to inlucde A-MPR analysis for n256; * R4-2511793, rest changes are based on agreements from this WF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The Release 19 NTN HPUE co-existence study and RF requirements analysis are not documented. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | (new) Section 6X, 7.4.2.1, 7.4.2.2.1, 7.4.2.2.2.1, 7.4.2.2.2.2, (new) 7.4.2.2.2.2.X, (new) 7.4.2.2.2.2.Y, 7.4.2.2.7, 7.4.3.2.2, (new) Annex X, (new) Annex Y, (new) Annex Z. | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | * The ‘NS\_24’ and its related contents in the Table 6.2.3.1-1 and 6.2.3.X in this CR is equivalent to the ‘NS\_24N’ in R4-2512532 (CR 0036). Thus the relevant content should be meregd to “NS\_24N” when implement both CRs. * The Annex F in R4-2512532 (CR 0036) should be placed into the same Annex Y in this CR. * The Section 6X, 7.4.2.2.2.2.X, 7.4.2.2.2.2.Y, Annex X, Annex Y and Annex Z are new section(annex) introduced into the TR, please re-name them accordingly. | | | | | | | | |
| ***X*** | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of Change>

# 6 Co-existence study

<Unchanged parts skipped, until end of section 6a>

<Insert new section: 6X (e.g. 6b)>

# 6X Co-existence study for NTN HPUE in FR1

## 6X.1 Co-existence simulation scenario for NTN HPUE in FR1

Scenarios for coexistence study are listed in Table 6X.1-1.

Table 6X.1-1: Scenarios for NTN HPUE co-existence

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FR1: 2GHz | | NTN1,4,5 | | |
| GEO3 | LEO 600km | LEO 1200km |
| NR/ NB-IoT | Rural | X | X | X |
| Urban macro | X | X | X |
| Dense Urban6 | N/A | N/A | N/A |
| NOTE 1: Earth Fixed beam has been considered for co-existence studies.  NOTE 2: Void  NOTE 3: GEO and LEO only operate at adjacent channel.  NOTE 4: Use GEO and LEO@600km when TN is victim.  NOTE 5: The satellite-to-satellite coexistence scenarios are not in the scope of this study considering this is already addressed by ITU (ITU RR Article 9 etc.) and regional regulations (e.g. FCC rules).  NOTE 6: Dense Urban is not considered as it is expected NTN UE will connect to terrestrial networks rather than satellite networks in such scenario. | | | | |

The aggressor and victim combinations are listed in Table 6X.1-2.

Table 6X.1-2: Aggressor and victim

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Combination | Aggressor | Victim | Notes |
| 4b | TN with NTN | NTN UL | TN UL | ACLR of NTN HPUE to be defined. |

For further visualisation of coexistence studies for NTN HPUE in FR1, the interference charts with respect to scenario 4b are further represented with respect to NTN-TN coexistence scenarios in Figure 6X.1-1.

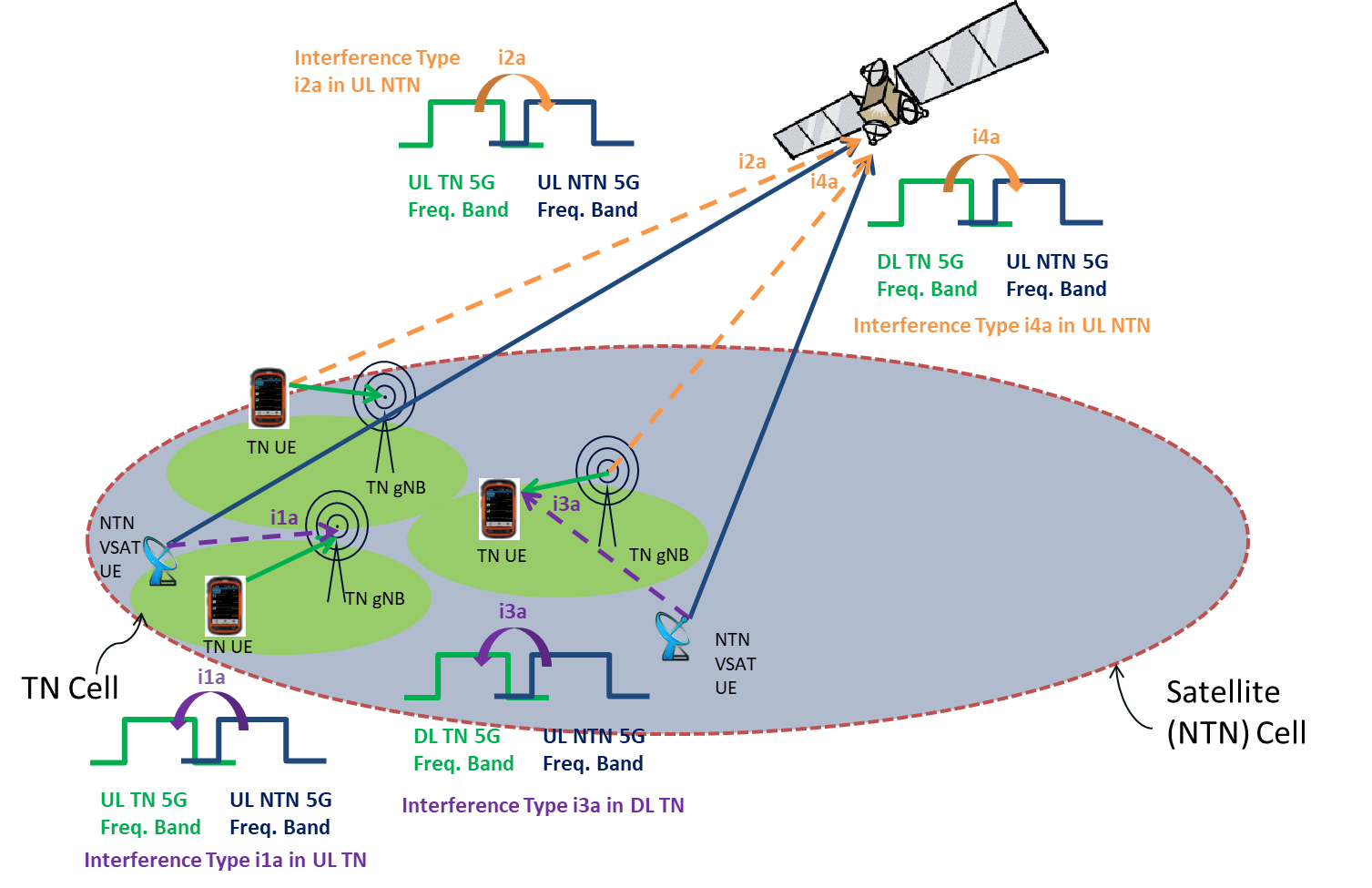


Figure 6X.1-1: NTN-TN adjacent band coexistence scenario 4b

The frequency and bandwidth are listed in Table 6X.1-3.

Table 6X.1-3: Proposed frequency and bandwidth for co-existence study

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Frequency | Bandwidth | | Duplex mode | Frequency reuse factor |
| NR-NTN | IoT-NTN |
| TN Rural | 2 GHz | 20MHz | | FDD, TDD | 1 |
| TN Urban macro | 2 GHz | 20MHz | | FDD, TDD | 1 |
| GEO | 2 GHz | 20 MHz for FR1 | 0.18MHz | FDD | 1, 31 |
| LEO | 2 GHz | 20 MHz for FR1 | 0.18MHz | FDD | 1, 31 |
| NOTE: Only FRF=1 has been used in co-existence studies for simplification. | | | | | |

## 6X.2 Co-existence simulation assumption for NTN HPUE in FR1

### 6X.2.1 Network layout model

#### 6X.2.1.1 Co-existence between NTN satellite and TN

Cellular cell structure is considered for both NTN satellite and TN network layout.

Referring to TR 38.811[5] Section 2.3 and Annex A, a 3D global coordinate system is considered (Earth-Centred Earth Fixed) for simulating NTN satellite beams direction and location on the earth surface. It means the NTN satellite beam location, TN randomly dropping location are generated with a set of three parameters (x,y,z).

Deployment of NTN satellite and TN cells and UEs for co-existence study is listed in Table 6X.2.1.1-1.

As defined in Figure 6X.2.1.1-1, isolation distance is the distance between the blue-dotted line which represents TN cell boarder and the red line. No UEs deployed in the isolation region is assumed to reduce the calculation complexity. The baseline is to use 2 x ISD (ISD = 750 meters) as the isolation distance

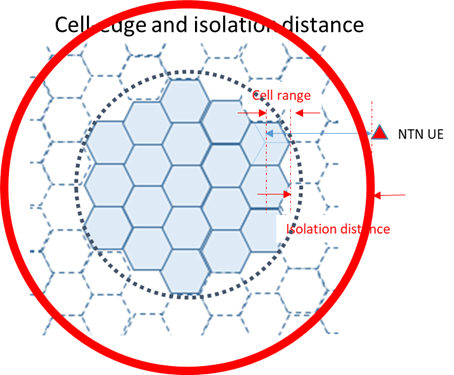


Figure 6X.2.1.1-1: Isolation distance

Table 6X.2.1.1-1: Network and UE deployment

| No. | Combination | Aggressor | Victim | Which NTN cell/UE to observe? | Which TN/UE to observe? | Which TN cells in a TN to observe? |
| --- | --- | --- | --- | --- | --- | --- |
| 4b | TN with NTN satellite | NTN UL | TN UL | NTN cell:  Nadir point.  NTN UE:  NTN UEs dropped at the edge of TN clusters | TN randomly placed in this NTN beam | Option 1: All active TN clusters which has the NTN UE(s) at its edge.  Option 2: Only the TN sectors which have NTN UE(s) at their edges. |

### 6X.2.2 System parameters

#### 6X.2.2.1 Satellite parameters

Set-1 satellite parameters are listed in Table 6X.2.2.1-2 and Table 6X.2.2.1-3 according to TR 38.821[6].

The satellite max Tx power can be calculated by the equation as below:

Table 6X.2.2.1-1: NRB configuration per BandWidth size and SCS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Configuration FR1 S-band | For IoT-NTN | For NR-NTN | | | |
| NRB (Subcarriers) | NRB (5MHz BW) | NRB (10MHz BW) | NRB (15MHz BW) | NRB (20MHz BW) |
| For IoT-NTN :  SCS 3.75kHz | 1 (12) | - | - | - | - |
| For NR-NTN and IoT-NTN :  SCS 15 kHz | 1 (48) | 25 | 52 | 79 | 106 |
| For NR-NTN :  SCS 30 kHz | - | 11 | 24 | 38 | 51 |

Table 6X.2.2.1-2a: Satellite parameters for co-existence study

(Note: For NR-NTN)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Satellite orbit | | | GEO | | | | LEO-1200 | | | | LEO-600 | | | |
| Satellite altitude | | | 35786 km | | | | 1200 km | | | | 600 km | | | |
| Payload characteristics for DL transmissions | | | | | | | | | | | | | | |
| Satellite EIRP density | | 2GHz | 59 dBW/MHz | | | | 40 dBW/MHz | | | | 34 dBW/MHz | | | |
| Satellite max TX power in dBm | BW (MHz) | 5 | 10 | 15 | 20 | 5 | 10 | 15 | 20 | 5 | 10 | 15 | 20 |
| SCS 15kHz | 44.53 | 47.71 | 49.53 | 50.81 | 46.53 | 49.71 | 51.53 | 52.81 | 40.53 | 43.71 | 45.53 | 46.81 |
| SCS 30kHz | 43.98 | 47.37 | 49.36 | 50.64 | 45.98 | 49.37 | 51.36 | 52.64 | 39.98 | 43.37 | 45.36 | 46.64 |
| Satellite Tx max Gain | | 51 dBi | | | | 30 dBi | | | | 30 dBi | | | |
| Channel bandwidth | | 5/10/15/20MHz | | | | 5/10/15/20MHz | | | | 5/10/15/20MHz | | | |
| 3dB beamwidth or HPBW (Half-Power BandWidth) of main central beam | | 0.4011 deg | | | | 4.4127 deg | | | | 4.4127 deg | | | |
| ABS (Adjacent Beam Spacing) of adjacent beams from the central beam | | 0.3474 deg | | | | 3.8206 deg | | | | 3.8206 deg | | | |
| Satellite beam diameter | | 250 km | | | | 90 km | | | | 50 km | | | |
| Payload characteristics for UL transmissions | | | | | | | | | | | | | | |
| G/T | | 2 GHz | 19 dB K-1 | | | | 1.1 dB K-1 | | | | 1.1 dB K-1 | | | |
| Satellite Rx max Gain | | 51 dBi | | | | 30 dBi | | | | 30 dBi | | | |

Table 6X.2.2.1-2b Satellite parameters for co-existence study

(Note: For IoT-NTN)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Satellite orbit | | | GEO | LEO-1200 | LEO-600 |
| Satellite altitude | | | 35786 km | 1200km | 600 km |
|  | | | Payload characteristics for DL transmissions | | | |
| Satellite EIRP density | | 2GHz | 59 dBW/MHz | 40 dBW/MHz | 34 dBW/MHz |
| Satellite max TX power in dBm | BW (MHz) | 0.18 **(NB-IoT)** | 0.18 **(NB-IoT)** | 0.18 **(NB-IoT)** |
| SCS 15kHz | 30.55 | 32.55 | 26.55 |
| SCS 3.75kHz | 30.55 | 32.55 | 26.55 |
| Satellite Tx max Gain | | 51 dBi | 30 dBi | 30 dBi |
| 3dB beamwidth or HPBW (Half-Power BandWidth) of main central beam | | 0.4011 deg | 4.4127 deg | 4.4127 deg |
| ABS (Adjacent Beam Spacing) of adjacent beams from the central beam | | 0.3474 deg | 3.8206 deg | 3.8206 deg |
| Satellite beam diameter | | 250 km | 90 km | 50 km |
|  | | | Payload characteristics for UL transmissions | | | |
| G/T | | 2 GHz | 19 dB K-1 | 1.1 dB K-1 | 1.1 dB K-1 |
| Satellite Rx max Gain | | 51 dBi | 30 dBi | 30 dBi |

Table 6X.2.2.1-3: Other parameters for NTN satellite

|  |  |  |
| --- | --- | --- |
| Parameters | NR-NTN | IoT NTN |
| Carrier frequency | 2GHz | 2GHz |
| The number of active UE (UL) | 9 UEs and 2RBs per UE for GEO and LEO1  **NOTE 2** | 9 for 15kHz SCS  18 and 36 for 3.75kHz SCS  (1 subcarrier per UE) |
| The number of active UE (DL) | 1 | 1 |
| Traffic model | Full buffer | Full buffer |
| DL power control | NO | NO |
| UL power control | See Session 2.2.6.2  **NOTE 2** | 36.942 section 5.1.1.6 (set 1) by bandwidth scale, target SNR at BS is 15 dB |
| UE Tx power in dBm (PC3) | -40 to 23 | -40 to 23 |
| UE Tx power in dBm (PC2) | -40 to 26 | -40 to 26 |
| UE Tx power in dBm (PC1.5) | -40 to 29 | - |
| UE Tx power in dBm (PC1) | -40 to 31 | -40 to 31 |
| NTN satellite Noise Figure in dB | See Table 2.3-3-1 | See Table 2.3-3-1 |
| Handover margin | 3dB | 3dB |
| **NOTE 1**: UEs are equally splitted inside the channel bandwidth into ACIR 3 regions. Scheduled PRB position for UE1 per satellite beam should be also fully aligned to simulate the worst case for co-channel interference and this is also aligned with full buffer case.  http://kr5.samsung.net/mail/rest/v1/files/image/download/202108260042453_CZHWKC3T.png?1=1&filepath=/LOCAL/ML/CACHE/image/y/20210825/110_31_JZ9R2KEKVGKD@namo.co.kr_4_yiran.jin&user=yiran.jin&partno=4&folderId=110&seqid=31&contentType=image%2Fpng  **NOTE 2**: For NR-NTN HPUE: Option 1: 3 dB SNR target and 5MHz UL BW (One company proposed for LEO only); Option 2: 15 dB SNR target and 2RB UL BW as baseline assumption  **NOTE 3**: Assuming all NR-NTN/IoT-NTN UEs are HPUE, i.e. 100% HPUE ratio as baseline. | | |

Table 6X.2.2.1-5: NTN satellite Noise Figure in dB

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite | GEO | LEO 600 | LEO 1200 |
| G/T (dB K-1) | 19 | 1.1 | 1.1 |
| G\_Rx (dBi) | 51 | 30 | 30 |
| NF (dB) | 7.4 | 4.3 | 4.3 |

#### 6X.2.2.2 NTN UE parameters

NTN UE parameters are given in Table 6X.2.2.2-1

Table 6X.2.2.2-1: NTN UE characteristics for system level simulations

|  |  |
| --- | --- |
| Characteristics | For NR-NTN and IoT-NTN |
| Frequency band | S band (i.e. 2 GHz) |
| Antenna type and configuration | (1, 1, 2) with omni-directional antenna element |
| Polarisation | Linear: +/-45°X-pol |
| Rx Antenna gain | 0 dBi per element |
| Antenna temperature | 290 K |
| Noise figure | 9 dB |
| Tx antenna gain | 0 dBi per element |

#### 6X.2.2.3 TN parameters

TN parameters for co-existence study are given in Table 6X.2.2.3-1, 6X.2.2.3-2 and 6X.2.2.3-3.

Table 6X.2.2.3-1: Simulation assumptions of TN respectively based on NR

|  |  |
| --- | --- |
|  | NR |
| Carrier frequency in GHz | 2 |
| Size of each nominal channel BW in MHz | 20 |
| Transmission bandwidth in MHz | N/A |
| Environment | Deployment scenario related, see Table 6X.2.2.3-2. |
| Network layout | 19-sites 57 sectors with wrap-around |
| Inter-site distance in meter | Deployment scenario related, see Table 6X.2.2.3-2 |
| System loading and activity | See Table 6X.2.1.1-1 |
| Network location | See Table 6X.2.1.1-1 |
| DL subcarrier spacing | 15kHz |
| UL | OFDMA |
| DL power control | No |
| UL power control | TR 36.942[8] |
| Frequency reuse | 1 |
| Number of scheduled UE per cell (DL) | 1 |
| Number of scheduled UE per cell (UL) | 3 |
| UE antenna height in meter | 1.5m |
| UE TX power in dBm | -40 to 23 |
| UE antenna gain in dBi | 0 |
| Building penetration loss | In pathloss model, TR 38.901[10] |
| Cell selection margin in dB | 3 |
| BS-MS min distance in meters | 35 |
| BS noise figure in dB | 5 |
| UE noise figure in dB | 9 |
| BS-UE path-loss model | TR 38.901[10] |
| Standard deviation of BS-UE log-normal shadow fading in dB | Deployment scenario related, referring to TR 38.901[10] |
| Shadowing correlation | Inter-cell 0.5  Intra-cell 1 |
| Link-level performance model | See Section 6X.2.8  Throughtput-SINR mapping |
| UE distribution | Uniform |
| Evaluation metrics | See Section 6X.2.8  Throughtput or SNR loss criteria |

Table 6X.2.2.3-2: Deployment-related parameters of TN (2 GHz)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Urban Macro | Rural Macro | Remarks |
| ISD in meters | 750 | 7500 | ITU-R Report M.2292[11] |
| BS Antenna height in meters | 25 | 30 |
| UE Outdoor/indoor | 100% Outdoor | |  |
| UE height in meter | 1.5 | 1.5 | RP-200559 [12] 3GPP LS to ITU-R WP5D and ITU-R WP5D [IMT\_Parameters] [13] |

Table 6X.2.2.3-3: ACLR/ACS for TN (2GHz)

|  |  |  |
| --- | --- | --- |
|  | | NR |
| BS | ACLR | 45 dB |
| ACS | 46 dB |
| UE | ACLR | 30dB (ACLR1)  43dB (ACLR2) |
| ACS | 33 |

### 6X.2.3 Antenna and beam forming pattern modelling

#### 6X.2.3.1 NTN SAN and NTN UE

Satellite and UE Antenna and beam forming pattern modelling of satellite could be referred to section 6.4.1 in TR 38.811[5].

The following normalized antenna gain pattern, corresponding to a typical reflector antenna with a circular aperture, is considered.

1

where:

- J1(x) is the Bessel function of the first kind and first order with argument ‘x’ , where x is ;

- a, is the radius of the antenna's circular aperture;

- k = 2f/c is the wave number;

- f is the frequency of operation;

- c is the speed of light in a vacuum and  is the angle measured from the bore sight of the antenna's main beam.

Note that *ka* equals to the number of wavelengths on the circumference of the aperture and is independent of the operating frequency.

The antenna patterns for LEO 600km, 1200km and GEO are shown in Figure 6X.2.3.1-1 and 6X.2.3.1-2.



Figure 6X.2.3.1-1: Antenna pattern for LEO 600KM and 1200KM (4.4127 deg for 3dB beamwidth)



Figure 6X.2.3.1-2: Antenna pattern for antenna aperture of GEO (0.4011 deg for 3dB beamwidth)

The beam layout definition for a single satellite simulation in S-Band is defined in Table 6X.2.3.1-1.

Table 6X.2.3.1-1: Beam layout definition for single satellite simulation

|  |  |
| --- | --- |
| Beam layout definition | Baseline: Hexagonal mapping of the beam bore sight directions on UV plane defined in the satellite reference frame.  Only the 3dB beam width parameters should be used. The beam diameter and beam spacing values can be computed directly from the 3 dB beam width assumptions and should be considered as informative. |
| Number of beams | Baseline: 7-beam layout (i.e. 6 co-frequency beams surrounding the central beam) |
| UV plane illustration (extracted from [19]) |  |
| UV plane convention | U axis is defined as the perpendicular line to the satellite-earth line on the orbital plane as illustrated here after:    The straight line being orthogonal to UV plane is pointing towards the Earth centre.  UV coordinates of the nadir of the reference satellite is (0,0) |
| Adjacent beam spacing on UV plane | Baseline: Adjacent beam spacing computation based on 3dB beam width of the satellite antenna pattern:  ABS[rad] = sqrt(3) x sin(HPBW[degrees]/2) or ABS[rad] = sqrt(3) x sinr(HPBW[rad]/2)  with ABS [degree]=180/pi x ABS[rad] and  with HPBW the Half-Power BandWidth of the main lobe from the satellite antenna pattern. |
| Central beam bore sight direction definition | Baseline:  Case 1: Central beam center is considered at nadir point  Case 2: 45° for GEO and LEO |
|  | Option 1: FRF=1 |
| Polarization re-use | Option 1: Disable  Option 2: Enable  Note: Polarization re-use should apply only if circular polarization for terminal antenna is considered |
| UEs outdoor/indoor distribution | 100% outdoor distribution for UEs |
| UE distribution | The cell area associated to a given beam is defined as the Voronoi cell associated with the corresponding beam centers. |
| UE orientation | Omnidirectional |
| UE attachment | RSRP |
| NOTE 1: Typical impairment values (additional frequency error, SNR loss) due to the feeder link except for delay can be considered to be negligible. When available, specific values can be considered in the evaluation and should be reported.  NOTE 2: For the calibration purpose, the ionospheric scintillation loss shall be considered equal to zero (i.e., the UEs are located between 20 and 60 degrees of latitude). | |

#### 6X.2.3.2 TN BS and TN UE

For AAS antenna, it refers to the pattern in TR 38.921 [14].

Table 6X.2.3.2-1: AAS antenna parameters for 2GHz

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Rural | Macro urban |
| 1 | Base Station Antenna Characteristics | | |
| 1.1 | Antenna pattern | TR 38.921[14] | |
| 1.2 | Element gain (dBi) (Note 2) | 7.1 | 6.4 |
| 1.3 | Horizontal/vertical 3 dB beam width of single element (degree) | 90º for H  54º for V | 90º for H  65º for V |
| 1.4 | Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V | 30 for both H/V |
| 1.5 | Antenna polarization | Linear ±45º | Linear ±45º |
| 1.6 | Antenna array configuration (Row × Column)  (Note 4) | 8 × 8 elements | 8 × 8 elements |
| 1.7 | Horizontal/Vertical radiating element spacing | 0.5 of wavelength for H, 0.9 of wavelength for V | 0.5 of wavelength for H, 0.7 of wavelength for V |
| 1.8 | Array Ohmic loss (dB) (Note 2) | 2 | 2 |
| 1.9 | Conducted power (before Ohmic loss) per antenna element (dBm) (Note 3) | 25 | 25 |
| 1.10 | Base station maximum coverage angle in the horizontal plane (degrees) | 120 | 120 |
| 1.11 | Base station vertical coverage range (degrees) (Note 1) | 90-100 | 90-120 |
| 1.12 | Mechanical downtilt (degrees) | 3 | 10 |

For non-AAS antenna, the parameters in Table 6X.2.3.2-1 are used for 2GHz BS antenna pattern in the NTN system simulation.

Table 6X.2.3.2-1: FR1 BS Non-AAS antenna pattern for 2GHz

|  |  |  |
| --- | --- | --- |
| Parameter for BS | Values | |
| Antenna vertical radiation pattern (dB) |  | |
| Antenna horizontal radiation pattern (dB) |  | |
| Combining method for 3D antenna pattern (dB) |  | |
| Maximum directional gain of an antenna *GE,max* | 17 dBi | |
| Conducted power | 46 dBm | |
| Mechanical downtilt in degrees | Rural | 3 |
| Urban | 10 |

For UE antennas, an omni-directional radiation pattern with antenna gain 0dBi is assumed.

### 6X.2.4 ACIR model

#### 6X.2.4.1 NR-NTN

ACLR modelling for TN and NTN co-existence study referring to clause 5.1.1.4.1 and 5.1.1.4.2 in TR 36.942[8] is used as baseline. The number of RBs refers to Table 6X.2.2.1-4 and Table 6X.2.2.3-1 respectively.

#### 6X.2.4.2 IoT-NTN

For scenario 4b, symmetric bandwidth IoT-NTN ACLR model is assumed according to TR 36.942 section 5.1.1.4.2 with flat NTN ACLR model and FACLR = 0 dB, assuming flat ACS.

### 6X.2.5 Propagation model

#### 6X.2.5.1 Propagation model between NTN SAN and UE

Propagation model between NTN SAN and UE should reference to section 6.6 in TR 38.811[5].

#### 6X.2.5.2 Propagation model between TN BS and UE

Propagation model between TN BS and UE should reference to section 7.4 in TR 38.901[10].

#### 6X.2.5.3 Propagation model between NTN SAN and TB BS

Propagation model between NTN SAN and TN BS should reference to TS 38.811[5] which is used for DL-UL cross link interference for S band.

### 6X.2.6 Transmission power control model

#### 6X.2.6.1 TN uplink transmission power control

For uplink scenario, transmission power control model specified in Section 9.1 TR 36.942[8] is applied for TN with following parameters.



where:

- Pmax = 23dBm,

- Rmin = -63 dB,

- CLx-ile and γ are set as following:

- CLx-ile = 88 + 10\*log10 (200/X) + 11 – Y, where X is UL transmission BW (MHz) and Y is the BS noise figure

- γ = 1For uplink scenario,

#### 6X.2.6.2 NTN uplink transmission power control

For NTN HPUE uplink trnasmission power control model, the following parameters are assumed:

* 

where:

- Pmax = 26dBm for PC2, 29 dBm for PC1.5, 31 dBm for PC1.

- Rmin = -66 dB for PC2, -69 dB for PC1.5, -71 dB, assuming -40dBm minimum output power,

- CLx-ile and γ are set as following:

- CLx-ile = 10\*log10(Pmax) – (SNRtarget + 10\*log10(kTB) + NF ),

* + Where:
  + SNRtarget and BW

For NR-NTN HPUE:

* + - Option 1: 3 dB SNR target and 5MHz UL BW (One company proposed for LEO only)
    - Option 2: 15 dB SNR target and 2RB UL BW as baseline assumption
  + NF is the SAN noise figure, i.e. 4.3dB.
  + 10log10(kT) = -174dBm/Hz.
  + γ = 1 For uplink scenario.

#### 6X.2.6.3 Downlink transmission power control

For downlink scenario, no power control scheme is applied to both NTN and TN scenarios.

### 6X.2.7 Received power model

See Section 6.2.7.

### 6X.2.8 Performance metric

See Section 6.2.8.

### 6X.2.9 Throughput ~ SNR mapping

See Section 6.2.9.

## 6X.3 Co-existence simulation methodology for NTN HPUE in FR1

### 6X.3.1 Simulation procedure

See section 6.3.1.

### 6X.3.2 Methods and principle to process co-existence simulation results

See section 6.3.2, noting that the following scenario is selected, in principle, to draw conclusion for NTN HPUE co-existence study.

Table 6X.3.2-1: Selected option for each scenario

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario | Aggressor system | Victim system | Environment | Contributing |
| 4b | NTN UL | TN UL | Urban | NTN UE ACLR |

## 6X.4 Co-existence simulation results for NTN HPUE in FR1

### 6X.4.1 NR-NTN Power Class 2: Scenario 4b

The co-existence results from all concerned options for NR-NTN power class 2 in this scenario were evaluated, and the detailed results can be found in Annex F to this TR. The numbers in below table have taken into account all the submitted results from these contributing companies for both average throughput loss and cell edge loss, and picked from the worst results from each source.

Table 6X.4.1-1 Interpolated required ACLR values for Scenario 4b with isolation distance 1.5km assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | <20 |
| Vivo | <20 |
| Ericsson | <20 |
| ZTE | 30.6 |
| Mediatek | <20 |
| Thales | <20 |
| Xiaomi | <20 |
| Qualcomm | <20 |
| **Average** | **<20** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

Table 6X.4.1-2 Interpolated required ACLR values for Scenario 4b without isolation distance assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | 25.9 |
| Vivo | 27.1 |
| Ericsson | 30.1 |
| Mediatek | 33 |
| Huawei | 23.7 |
| Xiaomi | 24.7 |
| Qualcomm | 20 |
| **Average** | **26.4** |

### 6X.4.2 NR-NTN Power Class 1.5: Scenario 4b

The co-existence results from all concerned options for NR-NTN power class 1.5 in this scenario were evaluated, and the detailed results can be found in Annex F to this TR. The numbers in below table have taken into account all the submitted results from these contributing companies for both average throughput loss and cell edge loss, and picked from the worst results from each source.

Table 6X.4.2-1 Interpolated required ACLR values for Scenario 4b with isolation distance 1.5km assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | <20 |
| Vivo | <20 |
| Ericsson | 14.4 |
| ZTE | 31.4 |
| Mediatek | 22.6 |
| Thales | 13 |
| Xiaomi | 23.2 |
| Qualcomm | <20 |
| **Average** | **<20.6** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

Table 6X.4.2-2 Interpolated required ACLR values for Scenario 4b without isolation distance assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | 29.3 |
| Vivo | 31.2 |
| Ericsson | 37.9 |
| Mediatek | 37.4 |
| Huawei | 26.2 |
| Xiaomi | 43.9 |
| Qualcomm | 20 |
| **Average** | **32.3** |

### 6X.4.3 NR-NTN Power Class 1: Scenario 4b

The co-existence results from all concerned options for NR-NTN power class 1 in this scenario were evaluated, and the detailed results can be found in Annex F to this TR. The numbers in below table have taken into account all the submitted results from these contributing companies for both average throughput loss and cell edge loss, and picked from the worst results from each source.

Table 6X.4.3-1 Interpolated required ACLR values for Scenario 4b with isolation distance 1.5km assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | <20 |
| Vivo | 20.5 |
| Ericsson | 14.4 |
| ZTE | 33.7 |
| Mediatek | 24.6 |
| Thales | <13 |
| Xiaomi | 25.1 |
| **Average** | **<21.6** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

Table 6X.4.3-2 Interpolated required ACLR values for Scenario 4b without isolation distance assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | 30.9 |
| Vivo | 34.5 |
| Ericsson | 40.3 |
| Mediatek | 39.4 |
| Huawei | 27.3 |
| Xiaomi | 38.6 |
| Qualcomm | 20 |
| **Average** | **35.2** |

### 6X.4.4 IoT-NTN Power Class 2: Scenario 4b

The co-existence results from all concerned options for IoT-NTN power class 2 in this scenario were evaluated, and the detailed results can be found in Annex F to this TR. The numbers in below table have taken into account all the submitted results from these contributing companies for both average throughput loss and cell edge loss, and picked from the worst results from each source.

Table 6X.4.4-1 Interpolated required ACLR values for Scenario 4b with isolation distance 1.5km assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | <20 |
| Vivo | <20 |
| ZTE | 39.2 |
| Mediatek | 9.2 |
| Xiaomi | 34.3 |
| Qualcomm | <20 |
| Ericsson | 13.4 |
| **Average** | **<22.8** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

Table 6X.4.4-2 Interpolated required ACLR values for Scenario 4b without isolation distance assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | 35.3 |
| Vivo | <20 |
| Mediatek | 33.6 |
| Qualcomm | <20 |
| **Average** | **<27.2** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

### 6X.4.5 IoT-NTN Power Class 1: Scenario 4b

The co-existence results from all concerned options for IoT-NTN power class 1 in this scenario were evaluated, and the detailed results can be found in Annex F to this TR. The numbers in below table have taken into account all the submitted results from these contributing companies for both average throughput loss and cell edge loss, and picked from the worst results from each source.

Table 6X.4.5-1 Interpolated required ACLR values for Scenario 4b with isolation distance 1.5km assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | <20 |
| Vivo | <20 |
| ZTE | 41.8 |
| Mediatek | 9.2 |
| Xiaomi | 42.4 |
| Qualcomm | <20 |
| Ericsson | 19.0 |
| **Average** | **<24.7** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

Table 6X.4.5-2 Interpolated required ACLR values for Scenario 4b without isolation distance assumed

|  |  |
| --- | --- |
| Company | Interpolated required ACLR |
| Samsung | 39.8 |
| Vivo | <20 |
| Mediatek | 33.6 |
| Qualcomm | 32 |
| **Average** | **<31.4** |
| Note: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level. | |

## 6X.5 Summary of co-existence study for NTN HPUE in FR1

The averaged interpolate ACLR values for each power class of NR-NTN and IoT-NTN in Scenario 4b are presented in Table 6X.5-1 below. It should be noted that only co-ex study results assuming 1.5km isolation distance are taken into account in this summary.

Table 6X.5-1: Average ACLR values for NTN HPUE in FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Power classes | | PC 2 | PC 1.5 | PC 1 |
| ACLR values  (dBc) | NR-NTN | <20 | <20.6 | <21.6 |
| IoT-NTN | <22.8 | Note 2 | <24.7 |
| Note 1: Some company’s results meet performance metrics at certain starting ACIR/ACLR level they used, e.g. 20dBc. These results are listed as smaller than those starting level.  Note 2: The power class 1.5 for IoT-NTN is not studied in this version. | | | | |

With the above averaged values from co-existence study and recognizing the characteristics of NTN HPUE in FR1 to the state of art and their future developments; and the protection to the operators in adjacent channel, the agreed ACLR of NR-NTN and IoT NTN HPUE are given in Table 6X.5.1-2.

Table 6X.5.1-2: ACLR and ACS of NTN HPUE in FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Power classes | | PC 2 | PC 1.5 | PC 1 |
| ACLR (dBc) | NR-NTN | 31 | 31 | 343 |
| NB-IoT based IoT-NTN | 371 | Note 2 | 371 |
| eMTC based IoT-NTN | 31 | Note 2 | [34]3 |
| Note 1: NB-IoT based IoT-NTN PC2 and PC1 ACLR reused from NB-IoT based IoT-NTN PC3 UTRA\_ACLR.  Note 2: The power class 1.5 for IoT-NTN is not studied in this version.  Note 3: It is observed in some company co-existence results that the 5%-ile throughput degradation is slightly higher than 5% with zero km isolation distance assumption. It was however agreed to progress with this ACLR as it faciliates UE RF implementation. | | | | |

<Next change>

### 7.4.2 UE Transmission characteristics for satellite access

#### 7.4.2.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0dBi is assumed.

<Next change>

##### 7.4.2.2.1 Maximum output power

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

Table 7.4.2.2.1-1: UE Power Class

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| NTN satellite band # | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
| n256 | 31 | +2/-3 | 26 | +2/-3 | 23 | ±2 |
| n255 | 31 | +2/-3 | 26 | +2/-3 | 23 | ±2 |
| n252 |  |  |  |  | 23 | +2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance  NOTE 2: Power class 3 is default power class unless otherwise stated  NOTE 3: Generally, PC1 UE are not targeted for smartphone form factor in this version of the specification. | | | | | | |

<Next change>

##### 7.4.2.2.2 MPR/AMPR

7.4.2.2.2.1 MPR

UE is allowed to reduce the maximum output power (MPR) due to higher order modulations and transmit bandwidth configurations to meet the general transmission requirements which includes in-band emission, ACLR, out-of-band emission and general spurious emission. As it was agreed those general transmission requirements for PC3 NTN UE can be reused from TN, the same requirements specified in Table 6.2.2-1 in TS 38.101-1 [17] can be reused for NTN satellite access UEs.

For PC2 UE with 1Tx and 2Tx, the allowed maximum power reduction (MPR) is defined as Table 6.2.2-2 in 3GPP TS 38.101-1[17] clause 6.2.2 and Table 6.2D.2-1 in 3GPP TS 38.101-1[17] clause 6.2D.2 respectively, except for 256QAM. For UE power class 1 with 1Tx, the allowed maximum power reduction (MPR) is defined in Table 7.4.2.2.2.1-1. And for UE power class 1 with 4Tx, the allowed maximum power reduction (MPR) is defined as Table 7.4.2.2.2.1-1a.

Table 7.4.2.2.2.1-1 Maximum power reduction (MPR) for power class 1 with 1Tx

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPR (dB) | | |
|  | | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 10.0 | ≤ 0.5 | ≤ 0 |
|  | QPSK | ≤ 10.5 | ≤ 1.0 | ≤ 0 |
|  | 16 QAM | ≤ 10.5 | ≤ 2.0 | ≤ 1.0 |
|  | 64 QAM | ≤ 10.5 | ≤ 2.5 | |
| CP-OFDM | QPSK | ≤ 11.0 | ≤ 3 | ≤ 1.5 |
|  | 16 QAM | ≤ 11.0 | ≤ 3 | ≤ 2.0 |
|  | 64 QAM | ≤ 11.0 | ≤3.5 | |

Table 7.4.2.2.2.1-1a Maximum power reduction (MPR) for power class 1 with 4Tx

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPR (dB) | | |
|  | | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 10.0 | ≤ 2.0 | ≤ 0.5 |
|  | QPSK | ≤ 10.5 | ≤ 2.5 | ≤ 0.5 |
|  | 16 QAM | ≤ 10.5 | ≤ 3.5 | ≤ 1.5 |
|  | 64 QAM | ≤ 10.5 | ≤ 4.0 | ≤ 3.5 |
| CP-OFDM | QPSK | ≤ 11.0 | ≤ 4.5 | ≤ 2.0 |
|  | 16 QAM | ≤ 11.0 | ≤ 4.5 | ≤ 2.5 |
|  | 64 QAM | ≤ 11.0 | ≤ 5.0 | ≤ 5.0 |
| NOTE 1: This table is targeted to devices with 15 dB or above antenna isolation. | | | | |

The definitions for Edge, Outer and Inner RB allocations defined in clause 6.2.2 of 3GPP TS 38.101-1 [17] shall apply to NTN UE, except for PC1 NTN UE.

For PC1 NTN UE, RB allocation is an Edge RB allocation if

AND ( OR ),

where

.

<Next change>

7.4.2.2.2.2 A-MPR

A-MPR is band specific requirement which is used to meet the additional requirements indicated by network signalling (NS) value.

For n256, based on the regulation conclusion in section 5.2, the A-MPR requirements for n65 could be as starting point. From TS 38.101-1, since the maximum carrier centre frequency of NS\_05 and NS\_05U is lower than 1960 MHz and the maximum carrier centre frequency of NS\_51 is lower than 1980 MHz, it is proposed NS\_05, NS\_05U and NS\_51 don’t need to be considered for n256. The requirements of NS\_01, NS\_24 and NS\_100 specified in Table 6.2.3.1-1 in TS 38.101-1 [17] for band n65 can be reused for n256.

For PC2 and PC1 NTN UE for band n256, the A-MPR analysis have been performed as documented in Annex Y, and the concluded A-MPR requirements can be found in sub-clause 7.4.2.2.2.2.X.

For n255, based on regulatory requirements, a new NS is required. The following observations were made from the measurement results using an LTE modem and transceiver supporting 1626.5 – 1656.5 MHz:

- For 5 MHz channel, PA emissions for DFT-s-OFDM are below the spurious emission limits between 1559 and 1606 MHz.

- For 10 MHz channel, PA emissions for DFT-s-OFDM are exceeding the spurious emission limits for 1 MHz MBW by 5 dB between 1604 and 1606 MHz.

- For 15 MHz channel, PA emissions for DFT-s-OFDM are exceeding the spurious emission limits for 1 MHz MBW by 9 dB between 1599 and 1606 MHz.

- For 20 MHz channel, PA emissions for DFT-s-OFDM are exceeding the spurious emission limits by 9 dB between 1584 and 1606 MHz.

- For 700 Hz MBW, PA emissions for all channel bandwidths are below the spurious emission limits between 1559 and 1606 MHz.

A n255 duplexer with rejection of more than 10 dB will be a sufficient to satisfy the spurious emission limits specified in Table 7.4.2.2.8-1.

Based on this measurement observations, the expected filter attenuation of more than 10 dB below 1610 MHz is going to be adequate to meet the additional emissions requirements between 1559 – 1610 MHz, and therefore, no A-MPR needs to be specified for n255.

In view of the above, the additional requirements with their associated network signalling values and the allowed A-MPR and applicable operating band(s) for each NS value shall be specified in Table 7.4.2.2.2.2-1 and the mapping of NR satellite band numbers and values of the *additionalSpectrumEmission* to network signalling labels is specified in Table 7.4.2.2.2.2-1A.

For PC2 and PC1 NTN UE for band n255, the A-MPR analysis have been performed as documented in Annex Z, and the concluded A-MPR requirements can be found in sub-clause 7.4.2.2.2.2.Y. These PC2 and PC1 A-MPR values for NS\_02N are specified with duplexer filter achieving at least 10 dB attenuation at frequencies 1610 MHz and below. Previous evaluation of duplexer data in R4-2016896 during the development of specifications of b24/n24 band showed that it is possible to achieve a higher attenuation than 10 dB which will likely to reduce the A-MPR being needed to meet the additional out of band emissions requirements related to NS\_02N.

For n252, the following three NSs are defined:

- NS\_06N: for protection of aeronautical radionavigation-satellite service. This requirement is based on FCC rule 47 C.F.R § 25.216 (e)

- NS\_07N and NS\_08N: for protection of n2/n25. This requirement applies based on coordination between operators and subject to regional/national regulation. See section 7.4.2.2.8 for detail on UE-to-UE coexistence additional spurious requirements. From UE perspective, UE applies this requirement based on the received NS value. For implementation flexibility, the requirement for aeronautical radionavigation-satellite service is also included in these NSs.

Table 7.4.2.2.2.2-1: Additional maximum power reduction (A-MPR)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Network signalling label | Requirements (clause) | NR satellite Band | Channel bandwidth (MHz) | Resources blocks (*N*RB) | A-MPR (dB) |
| NS\_01 |  | Table 5.2.1-1 | 5, 10, 15, 20 | Table 5.3.2-1 in TS 38.101-1 | N/A |
| NS\_02N | 6.5.3.3.1 | n255 | 5, 10, 15, 20 | Table 7.4.2.2.2.2.Y-1,  Table 7.4.2.2.2.2.Y-3 | Table 7.4.2.2.2.2.Y-2,  Table 7.4.2.2.2.2.Y-4,  Table 7.4.2.2.2.2.Y-4a |
| NS\_24 | 6.5.3.3.13 in TS 38.101-1 | n256 | 5, 10, 15, 20 | Table 6.2.3.15-1 in TS 38.101-1  Table 7.4.2.2.2.2.X-1,  Table 7.4.2.2.2.2.X-3 | Clause 6.2.3.7 in TS 38.101-12  Table7.4.2.2.2.2.X-2,  Table 7.4.2.2.2.2.X-4 |
| NS\_100 | 6.5.2.4.2 in TS 38.101-1 | n2561 |  |  | Table  6.2.3.1-2 in TS 38.101-1 |
| NS\_06N | 7.4.2.2.8 | n252 | 5, 10, 15, 20 |  | N/A |
| NS\_07N | 7.4.2.2.8 | n252 | 5, 10, 15, 20 |  | Table 7.4.2.2.2.2.1-2 |
| NS\_08N | 7.4.2.2.8 | n252 | 5, 10, 15, 20 |  | Table 7.4.2.2.2.2.2-2 |
| NOTE 1: This NS can be signalled for NTN satellite bands that have UTRA services deployed.  NOTE 2: A-MPR for the upper 5 MHz is not specified, and therefore shall be used as a guard band.  NOTE 3: The NS\_07N and NS\_08N is signalled based on coordination between operators and subject to regional/national regulation | | | | | |

Table 7.4.2.2.2.2-1A: Mapping of network signalling label

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NTN satellite band | Value of additionalSpectrumEmission | | | | | | | |
|  | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| n256 | NS\_01 | NS\_24 | NS\_100 |  |  |  |  |  |
| n255 | NS\_01 | NS\_02N |  |  |  |  |  |  |
| n252 | NS\_01 | NS\_06N | NS\_07N | NS\_08N |  |  |  |  |
| NOTE: *additionalSpectrumEmission* corresponds to an information element of the same name defined in clause 6.3.2 of TS 38.331. | | | | | | | | |

For n256, FFS for how to protect n2, n25, n70 and whether A-MPR required.

<Unchanged parts skipped, until end of sub-clauses of 7.4.2.2.2.2.2>

<Insert new sub-clause: 7.4.2.2.2.2.X>

#### 7.4.2.2.2.2.X A-MPR for NS\_24

Table 7.4.2.2.2.2.X-1: A-MPR regions for NS\_24 (Power Class 2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | | Region D | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.24 | A4 |  | ≤ 3.24 | A8 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤ 3.6 | ≤1.98 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | Fc = 1985 | >5.4 |  | A4 |  | ≥ 4.5 | A8 |  |  |  |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 | ≥3.06  <5.76 | ≤1.44 | A8 |
| 15MHz | Fc = 1987.5 |  | >6.84 | A1 | ≥10.8 | >1.08 ≤6.84 | A2 | <10.8 | ≤6.84 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <4.04 |  | A5 | ≥4.04  <8.64 | >1.44 | A6 | ≥4.04  <8.64 | ≤1.44 | A8 |
| 20MHz | Fc = 1990 | ≥12.96 |  | A5 | <4.68 |  | A5 | ≥4.68  <12.96 | >2.16 | A6 | ≥ 4.68  < 12.96 | ≤2.16 | A8 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.58 |  | A5 | ≥5.58  <11.52 | >1.44 | A6 | ≥ 5.58  < 11.52 | ≤1.44 | A8 |

Table 7.4.2.2.2.2.X-2: A-MPR for NS\_24 (Power Class 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
| Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 14 | ≤ 8 | ≤ 6.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 5.0 | ≤ 3 |
| QPSK | ≤ 14 | ≤ 8 | ≤ 6.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 5.0 | ≤ 3 |
| 16 QAM | ≤ 14 | ≤ 8 | ≤ 6.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 5.0 | ≤ 4 |
| 64 QAM | ≤ 14 | ≤ 8 | ≤ 7 | ≤ 8.5 | ≤ 22 | ≤ 13 | ≤ 5.0 | ≤ 4.5 |
| CP-OFDM | QPSK | ≤ 15 | ≤ 9 | ≤ 7 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 6.5 | ≤ 4.5 |
| 16 QAM | ≤ 15 | ≤ 9 | ≤ 7 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 6.5 | ≤ 5 |
| 64 QAM | ≤ 15 | ≤ 9 | ≤ 7 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 6.5 | ≤ 5 |

Table 7.4.2.2.2.2.X-3: A-MPR regions for NS\_24 (Power Class 1)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | | Region D | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1982.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  | ≤ 3.24 | A9 |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.24 | A4 |  | ≤ 3.24 | A8 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | Fc = 1985 | >5.4 |  | A4 |  | ≤ 5.4  ≥ 4.5 | A8 |  | < 4.5 | A9 |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 | ≥3.06  <5.76 | ≤1.44 | A8 |
| 15MHz | Fc = 1987.5 |  | >6.84 | A1 | ≥10.8 | >1.08 ≤6.84 | A2 | <10.8 | ≤6.84 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <4.04 |  | A5 | ≥4.04  <8.64 | >1.44 | A6 | ≥4.04  <8.64 | ≤1.44 | A8 |
| 20MHz | Fc = 1990 | ≥12.96 |  | A5 | <4.68 |  | A5 | ≥4.68  <12.96 | >2.16 | A6 | ≥ 4.68  < 12.96 | ≤2.16 | A8 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.58 |  | A5 | ≥5.58  <11.52 | >1.44 | A6 | ≥ 5.58  < 11.52 | ≤1.44 | A8 |

Table 7.4.2.2.2.2.X-2: A-MPR for NS\_24 (Power Class 1)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
| Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 19 | ≤ 13 | ≤ 10.5 | ≤ 11.5 | ≤ 26 | ≤ 18 | ≤ 7 | ≤ 8 | ≤ 4.5 |
| QPSK | ≤ 19 | ≤ 13 | ≤ 10.5 | ≤ 11.5 | ≤ 26 | ≤ 18 | ≤ 7 | ≤ 8 | ≤ 4.5 |
| 16 QAM | ≤ 19 | ≤ 13 | ≤ 10.5 | ≤ 11.5 | ≤ 26 | ≤ 18 | ≤ 7 | ≤ 9 | ≤ 4.5 |
| 64 QAM | ≤ 19 | ≤ 13 | ≤ 11 | ≤ 11.5 | ≤ 27 | ≤ 18 | ≤ 7 | ≤ 9.5 | ≤ 5 |
| CP-OFDM | QPSK | ≤ 20 | ≤ 14 | ≤ 11 | ≤ 11.5 | ≤ 27 | ≤ 20 | ≤ 8 | ≤ 9.5 | ≤ 5.5 |
| 16 QAM | ≤ 20 | ≤ 14 | ≤ 11 | ≤ 11.5 | ≤ 27 | ≤ 20 | ≤ 8 | ≤ 10 | ≤ 5.5 |
| 64 QAM | ≤ 20 | ≤ 14 | ≤ 11 | ≤ 11.5 | ≤ 27 | ≤ 20 | ≤ 8 | ≤ 10 | ≤ 5.5 |

<Insert new sub-clause: 7.4.2.2.2.2.Y>

#### 7.4.2.2.2.2.Y A-MPR for NS\_02N

Table 7.4.2.2.2.2.Y-1: A-MPR regions for NS\_02N (Power Class 2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel BW** | **Carrier Frequency, Fc, MHz** | **RBStart\*12\*SCS (MHz)** | **LCRB\*12\*SCS (MHz)** | **A-MPR** |
| 15MHz | 1634 < Fc ≤ 1645 |  | > 10.8 | A2 |
| 20MHz | 1636.5 ≤ Fc ≤ 1650.5 | ≤ 0.54 | < 1.8 | A1 |
|  | > 10.8 | A1 |

Table 7.4.2.2.2.2.Y-2: A-MPR for NS\_02N (Power Class 2)

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | | A1 (dB) | A2 (dB) |
|  | | Outer/Inner | Outer/Inner |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 2.5 | ≤ 1.0 |
| QPSK | ≤ 3.0 | ≤ 2.0 |
| 16 QAM | ≤ 3.5 | ≤ 2.5 |
| 64 QAM | ≤ 4.0 | ≤ 3.0 |
| CP-OFDM | QPSK | ≤ 4.5 | ≤ 3.5 |
| 16 QAM | ≤ 4.5 | ≤ 3.5 |
| 64 QAM | ≤ 4.5 | ≤ 4 |

Table 7.4.2.2.2.2.Y-3: A-MPR regions for NS\_02N (Power Class 1 with 1Tx or 4Tx)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Channel BW** | **Carrier Frequency, Fc, MHz** | **RBStart\*12\*SCS (MHz)** | **LCRB\*12\*SCS (MHz)** | **A-MPR** |
| 15MHz | 1634 < Fc ≤ 1645 |  | > 10.8 | A2 |
| 20MHz | 1636.5 ≤ Fc ≤ 1650.5 | ≤ 0.54 | < 1.8 | A1 |
|  | > 14.4 | A1 |
|  | >10.8, ≤ 14.4 | A2 |

Table 7.4.2.2.2.2.Y-4: A-MPR for NS\_02N (Power Class 1 with 1Tx)

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | | A1 (dB) | A2 (dB) |
|  | | Outer/Inner | Outer/Inner |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.0 | ≤ 3.0 |
| QPSK | ≤ 5.0 | ≤ 3.0 |
| 16 QAM | ≤ 5.0 | ≤ 3.5 |
| 64 QAM | ≤ 5.5 | ≤ 4.0 |
| CP-OFDM | QPSK | ≤ 6.0 | ≤ 4.0 |
| 16 QAM | ≤ 6.0 | ≤ 4.0 |
| 64 QAM | ≤ 6.0 | ≤ 4.0 |

Table 7.4.2.2.2.2.Y-4a: A-MPR for NS\_02N (Power Class 1 with 4Tx)

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation/Waveform | | A1 (dB) | A2 (dB) |
|  | | Outer/Inner | Outer/Inner |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 6.0 | ≤ 4.0 |
| QPSK | ≤ 6.0 | ≤ 4.0 |
| 16 QAM | ≤ 6.0 | ≤ 4.5 |
| 64 QAM | ≤ 6.5 | ≤ 5.0 |
| CP-OFDM | QPSK | ≤ 7.0 | ≤ 5.0 |
| 16 QAM | ≤ 7.0 | ≤ 5.0 |
| 64 QAM | ≤ 7.0 | ≤ 5.0 |

<Next change>

##### 7.4.2.2.7 ACLR

For ACLR, for PC3 and PC2 the same ACLR for TN NR UE which is specified in TS 38.101-1 [17] sub-clause 6.5.2.4.1 can be applied for NTN satellite access UEs. For PC1, a relaxed ACLR requirement of 34dB compared to that in TN NR has been specified as a trade-off between the required protection of adjacent bands, as determined by coexistence studies, and the challenges of UE implementation.

The requirement of ALCR is specified in Table 7.4.2.2.7-1.

Table 7.4.2.2.7-1: NTN satellite access UE ACLR requirement

|  |  |  |  |
| --- | --- | --- | --- |
|  | Power class 1 | Power class 2 | Power class 3 |
| NTN UE ALCR | 34 dB | 31 dB | 30 dB |

<Next change>

##### 7.4.3.2.2 Reference sensitivity

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel. For below 6GHz, the REFSENS level can be calculated by the equation below in TR 38.817-01[32]:

Sensitivity = -174dBm(kT) + 10\*log(RX BW) + NF + SNR +IM – diversity gain

It is noted that the Rx BW is identical to the transmission bandwidth configuration, which is determined by the spectrum utilization. The RB values in the analysis of this contribution are based on the agreed SU for NR.

SNR in Nagoya meeting was agreed as -1dB for NR.

The REFSENS for E-UTRA assumes that the receiver is equipped with two Rx port as a baseline. If 2Rx is considered, the diversity gain is 3dB and the Implementation Margin (IM) uses 2.5dB. In the following calculation, same assumptions are used for NR NTN satellite bands.

For band n255, 9dB noise figure is assumed which is aligned with band n24.

Both dedicate 30MHz duplexer and n65 duplexer are allowed to be used for band n256. Finally, 9dB noise figure is assumed for band n256 as well.

For n252, RAN4 agreed that as a starting point the UE REFSENS value for n252 is aligned with the values for n256.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2 and A.3.2 from TS 38.101-1 [17] (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1 from TS 38.101-1 [17]) with parameters specified in Table 7.4.3.2.2-1 and Table 7.4.3.2.2-2.

Table 7.4.3.2.2-1: Two antenna port reference sensitivity QPSK REFSENS

| **Operating band / SCS / Channel bandwidth / Duplex-mode** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **NTN satellite band #** | **SCS kHz** | **5**  **MHz (dBm)** | **10**  **MHz (dBm)** | **15**  **MHz (dBm)** | **20**  **MHz (dBm)** | **Duplex Mode** |
|  | 15 | -100.0 | -96.8 | -95.0 | -93.8 |  |
| n255 | 30 |  | -97.1 | -95.1 | -94.0 | FDD |
|  | 60 |  | -97.5 | -95.4 | -94.2 |  |
|  | 15 | -100.0 | -96.8 | -95.0 | -93.8 |  |
| n256 | 30 |  | -97.1 | -95.1 | -94.0 | FDD |
|  | 60 |  | -97.5 | -95.4 | -94.2 |  |
|  | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |
| n252 | 30 |  | -96.6 | -94.6 | -93.5 | FDD |
|  | 60 |  | -97.0 | -94.9 | -93.7 |  |

For power class 2 and power class 1 UEs, certain degradation of the reference sensitivity in Table 7.4.3.2.2-1 is allowed. For a power class 2 UE the maximum amount of degradation is specified in Table 7.4.3.2.2-1a, and in Table 7.4.3.2.2-1b for a UE that indicates *txDiversity-r16* or *txDiversity2Tx-r18*. For a power class 1 UE the maximum amount of degradation is specified in Table 7.4.3.2.2-1c, and in Table 7.4.3.2.2-1d for a UE that indicates *txDiversity-4Tx-r18*.

**Table 7.3.2-1a Reference Sensitivity Degradation from PC3 to PC2 for FDD bands for UE with 1Tx**

| **Operating Band** | **5**  **MHz (dB)** | **10**  **MHz (dB)** | **15**  **MHz (dB)** | **20**  **MHz (dB)** | **25**  **MHz (dB)** | **30 MHz (dB)** | **35 MHz (dB)** | **40**  **MHz (dB)** | **45 MHz (dB)** | **50**  **MHz (dB)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n256 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |
| n255 | 0.8 | 0.8 | 0.9 | 0.9 |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | |

**Table 7.3.2-1b Reference Sensitivity Degradation from PC3 to PC2 for  
FDD bands for UE with 2Tx**

| **Operating Band** | **5**  **MHz (dB)** | **10**  **MHz (dB)** | **15**  **MHz (dB)** | **20**  **MHz (dB)** | **25**  **MHz (dB)** | **30 MHz (dB)** | **35 MHz (dB)** | **40**  **MHz (dB)** | **45 MHz (dB)** | **50**  **MHz (dB)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n256 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |
| n255 | 1.6 | 1.6 | 1.7 | 1.7 |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | |

**Table 7.3.2-1c Reference Sensitivity Degradation from PC3 to PC1 for  
FDD bands for UE with 1Tx**

| **Operating Band** | **5**  **MHz (dB)** | **10**  **MHz (dB)** | **15**  **MHz (dB)** | **20**  **MHz (dB)** | **25**  **MHz (dB)** | **30 MHz (dB)** | **35 MHz (dB)** | **40**  **MHz (dB)** | **45 MHz (dB)** | **50**  **MHz (dB)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n256 | 1.5 | 1.5 | 1.5 | 1.5 |  |  |  |  |  |  |
| n255 | 2 | 2 | 2 | 2 |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | |

**Table 7.3.2-1d Reference Sensitivity Degradation from PC3 to PC1 for  
FDD bands for UE with 4Tx**

| **Operating Band** | **5**  **MHz (dB)** | **10**  **MHz (dB)** | **15**  **MHz (dB)** | **20**  **MHz (dB)** | **25**  **MHz (dB)** | **30 MHz (dB)** | **35 MHz (dB)** | **40**  **MHz (dB)** | **45 MHz (dB)** | **50**  **MHz (dB)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n256 | 2.1 | 2.1 | 2.1 | 2.1 |  |  |  |  |  |  |
| n255 | 3.3 | 3.3 | 3.3 | 3.3 |  |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | |

Table 7.4.3.2.2-2: Uplink configuration for reference sensitivity

| **Operating band / SCS / Channel bandwidth / Duplex-mode** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **NTN satellite band #** | **SCS kHz** | **5**  **MHz (dBm)** | **10**  **MHz (dBm)** | **15**  **MHz (dBm)** | **20**  **MHz (dBm)** | **Duplex Mode** |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n255 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n256 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n252 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |

<Next change: Insert new Annex X after End of existing Annexes>

Annex X:  
Summary of NTN HPUE simulation results

All NTN HPUE co-existence study results have been captured in the list. Please see attachment Summary of NTN HPUE simulation results.

<Next change: Insert new Annex Y>

Annex Y:  
Power back-off simulation results for the S-band

## Y.1 PC3 power class

### Y.1.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

## Y.2 PC2 power class

### Y.2.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Y.2.1.1 NS\_24N

##### Y.2.1.1.1 Company A (MediaTek/R4-2509854)

###### Y.2.1.1.1.1 Simulation assumptionsY.2.1.1.1.2 Simulation results

Table below summarises proposed A-MPR values for the existing A-MPR regions, i.e., same regions that already exist for the PC3 power class.

Table Y.2.1.1.1.2-1: Proposed A-MPR regions and values

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|  | Outer/  Inner | Outer/  Inner | Outer/  Inner | Outer | Outer/  Inner | Outer/  Inner | Outer |
| DFT-s-OFDM PI/2 BPSK | ≤ 12.5 | ≤ 7 | ≤ 4.5 | ≤ 8.5 | ≤ 19.6 | ≤ 11.7 | ≤ 3.5 |
| DFT-s-OFDM QPSK | ≤ 12.5 | ≤ 7 | ≤ 4.5 | ≤ 8.5 | ≤ 19.6 | ≤ 11.7 | ≤ 3.5 |
| DFT-s-OFDM 16 QAM | ≤ 13.3 | ≤ 7.1 | ≤ 5.2 | ≤ 8.5 | ≤ 21 | ≤ 13.0 | ≤ 3.5 |
| DFT-s-OFDM 64 QAM | ≤ 13.3 | ≤ 7.1 | ≤ 5.2 | ≤ 8.5 | ≤ 21 | ≤ 13.5 | ≤ 3.5 |
| DFT-s-OFDM 256 QAM | ≤ 13.3 | ≤ 7.1 |  | ≤ 8.5 | ≤ 21 | ≤ 13.5 |  |
| CP-OFDM QPSK | ≤ 13.9 | ≤ 7.3 | ≤ 5.6 | ≤ 8.5 | ≤ 22.1 | ≤ 15.5 | ≤ 5.5 |
| CP-OFDM 16 QAM | ≤ 13.9 | ≤ 7.3 | ≤ 5.6 | ≤ 8.5 | ≤ 22.6 | ≤ 15.9 | ≤ 5.5 |
| CP-OFDM 64 QAM | ≤ 13.9 | ≤ 7.3 | ≤ 5.6 | ≤ 8.5 | ≤ 22.6 | ≤ 15.9 | ≤ 5.5 |
| CP-OFDM 256 QAM | ≤ 13.9 | ≤ 7.3 |  | ≤ 8.5 | ≤ 22.6 | ≤ 16.1 |  |

##### Y.2.1.1.2 Company B (Qualcomm/R4-2511400)

###### Y.2.1.1.2.1 Simulation assumptions

###### Y.2.1.1.2.2 Simulation results

In the table below, A-MPR regions A to C are the existing regions from the PC3 power, and region D is a new A-MPR reion.

Table Y.2.1.1.2.2-1: Proposed A-MPR regions and values

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | | Region D | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.24 | A4 |  | ≤ 3.24 | A8 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | Fc = 1985 | >5.4 |  | A4 |  | ≥ 4.5 | A8 |  |  |  |  |  |  |
| 10MHz | 1985 ≤ Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 | ≥3.06  <5.76 | ≤1.44 | A8 |
| 15MHz | Fc = 1987.5 |  | >6.84 | A1 | ≥10.8 | >1.08 ≤6.84 | A2 | <10.8 | ≤6.84 | A3 |  |  |  |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |  |  |  |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <4.04 |  | A5 | ≥4.04  <8.64 | >1.44 | A6 | ≥4.04  <8.64 | ≤1.44 | A8 |
| 20MHz | Fc = 1990 | ≥12.96 |  | A5 | <4.68 |  | A5 | ≥4.68  <12.96 | >2.16 | A6 | ≥ 4.68  < 12.96 | ≤2.16 | A8 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.58 |  | A5 | ≥5.58  <11.52 | >1.44 | A6 | ≥ 5.58  < 11.52 | ≤1.44 | A8 |
|  | | | | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 14 | ≤ 8 | ≤ 5.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 4.5 | ≤ 3 |
| DFT-s-OFDM QPSK | ≤ 14 | ≤ 8 | ≤ 5.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 4.5 | ≤ 3 |
| DFT-s-OFDM 16 QAM | ≤ 14 | ≤ 8 | ≤ 5.5 | ≤ 8.5 | ≤ 21 | ≤ 13 | ≤ 4.5 | ≤ 4 |
| DFT-s-OFDM 64 QAM | ≤ 14 | ≤ 8 | ≤ 6 | ≤ 8.5 | ≤ 22 | ≤ 13 | ≤ 4.5 | ≤ 4.5 |
| CP-OFDM QPSK | ≤ 15 | ≤ 9 | ≤ 6.5 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 5.5 | ≤ 4.5 |
| CP-OFDM 16 QAM | ≤ 15 | ≤ 9 | ≤ 6.5 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 5.5 | ≤ 5 |
| CP-OFDM 64 QAM | ≤ 15 | ≤ 9 | ≤ 6.5 | ≤ 8.5 | ≤ 22 | ≤ 15 | ≤ 5.5 | ≤ 5 |
|  | | | | | | | | |

##### Y.2.1.1.3 Company C (R4-2510521/OPPO)

###### Y.2.1.1.3.1 Simulation assumptions

The simulation assumptions are as follows:

- PC2 power class with 1Tx

- 5,10, 15 and 20MHz channels residing at the higher edge of the uplink operating band n256 and keeping 5MHz protecting guard gap between the higher edge of the channel bandwidth and the highest edge of the uplink operating band.

- CP-OFDM and DFT-s-OFDM

###### Y.2.1.1.3.2 Simulation results

To assess PC2 power back-off values and potential A-MPR regions, PC2 CP-OFDM QPSK power back-off values are compared to the corresponding results obtained for the PC3 power class under the existing A-MPR regions. Based on that the following observations are made:

- The PC3 power back-off simulations results have more margins compared the current region frame and related AMPR values in existing specification.

- Some regions for PC2 are extended compared with PC3 due to higher output power, i.e., A5 region for 10MHz, 15MHz and 20 MHz, A1 region for 5MHz and 10MHz, A4 region for 5MHz.

- The power back-off value of A6 region in Y.2.1.1.3.2-1 is 5dB smaller than the value of A6 region in Y.2.1.1.3.2-2.

**A diagram of a triangle

AI-generated content may be incorrect.**

Figure Y.2.1.1.3.2-1: A-MPR regions for the for 5MHz channel at 1997.5 < Fc ≤ 2002.5 and 10MHz channel at 1985 < Fc ≤ 1995

**A diagram of a triangle

AI-generated content may be incorrect.**

Figure Y.2.1.1.3.2-2: A-MPR regions for the for 10MHz at 1995 < Fc ≤ 2000, 15MHz and 20MHz.

According to the simulation results, A-MPR regions for NS\_24N can reuse same regions as the existing PC3 regions. However, some region ranges should be extended compared to PC3, i.e., A5 region for 10MHz, 15MHz and 20 MHz, A1 region for 5MHz and 10MHz, A4 region for 5MHz. It is also necessary to a new region name for the A6 region in Figure Y.2.1.1.3.2-2 for 10MHz, 15MHz, and 20MHz to distinguish with the A6 region in Y.2.1.1.3.2-1 for 5MHz and 10MHz, i.e., A8 replace A6.

In the figures below further results are presented for NS\_24N with PC2 10MHz at Fc=2000MHz under different modulations with CP-OFDM and DFT-s-OFDM waveforms, whereupon the simulation results are based on fixed bias PA.

A diagram of a graph

AI-generated content may be incorrect.

Figure Y.2.1.1.3.2-3: AMPR for PC2 10MHz CP-OFDM under different modulations.

A diagram of a variety of colors

AI-generated content may be incorrect.

Figure Y.2.1.1.3.2-4: AMPR for PC2 10MHz DFT-s-OFDM under different modulations.

Table Y.2.1.1.3.2-1 proposes A-MPR regions and power back-off values, which are based on the existing PC3 regions.

Table Y.2.1.1.3.2-1: Proposed A-MPR values and regions based on existing PC3 A-MPR regions

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.24 | A4 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <3.78 |  | A5 | ≥3.78  <8.64 | >1.44 | A6 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.58 |  | A5 | ≥5.58  <11.52 | >1.44 | A6 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/ Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| CP-OFDM QPSK | 16 | 12 | 11 | 9.5 | 26 | 21 | 8.5 |
| CP-OFDM 16QAM | 16 | 12 | 11 | 9.5 | 26 | 21 | 8.5 |
| CP-OFDM 64QAM | 16 | 12 | 11 | 9.5 | 26 | 21 | 8.5 |
| DFT-s-OFDM pi/2 BPSK | 15 | 11 | 10 | 8.5 | 26 | 20 | 7.5 |
| DFT-s-OFDM QPSK | 15 | 11 | 10 | 8.5 | 26 | 20 | 7.5 |
| DFT-s-OFDM 16QAM | 15 | 11 | 10 | 8.5 | 26 | 20 | 7.5 |
| DFT-s-OFDM 64QAM | 15 | 11 | 10 | 8.5 | 26 | 20 | 7.5 |

If we use the modified regions as shown in Table Y.2.1.1.3.2-2 for PC2 AMPR, we can see that the regions of A1, A4 and A5 are extended, but regions A2, A3 and A8 are reduced.

Table Y.2.1.1.3.2-2: Proposed values based on modified AMPR regions

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | > 2.16 | A4 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | > 1.44 | A1 | > 2.7 | >1.08 ≤ 1.44 | A2 | ≤2.7 | ≤  1.44 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | > 3.24 | A1 | ≥ 5.4 | > 2.16 ≤ 3.24 | A2 | < 5.4 | ≤ 3.24 | A3 |
|  |  |  |  |  |  | ≤ 2.16 | A6 |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥ 5.4 |  | A5 | < 3.42 |  | A5 | ≥ 3.42  <5.4 | >1.08 | A8 |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | < 5.94 |  | A5 | ≥ 5.94  <8.64 | >1.44 | A8 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <7.74 |  | A5 | ≥7.74  <11.52 | >1.44 | A8 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/ Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A8 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | | Outer |
| CP-OFDM QPSK /16QAM/64QAM | ≤ 16 | ≤ 10 | ≤ 10 | ≤ 9.5 | ≤ 26 | ≤ 12 | ≤ 17 | ≤ 8.5 |
| DFT-s-OFDM pi/2 BPSK /QPSK/16QAM/64QAM | ≤ 15 | ≤ 9 | ≤ 9 | ≤ 8.5 | ≤ 26 | ≤ 11 | ≤ 16 | ≤ 7.5 |

##### Y.2.1.1.4 Company D (R4-2511269/Nokia)

###### Y.2.1.1.4.1 Simulation assumptions

The following simulation assumptions are made:

- Operating band n256 (UL 1980 MHz – 2010 MHz)

- 5MHz, 10 MHz, 15 MHz, and 20 MHz channel bandwidth

- Power class PC2

- WOLA processing

- I/Q image -28 dBc (default according to 38.101-1, Table 6.4.2.3-1) for other modulations than 256QAM

- For 256QAM the I/Q image is -33.7 dBc as in MPR simulations.

- Carrier leakage -28 dBc (default according to 38.101-1, Table 6.4.2.3-1)

- CIM3 -60 dBc

- CIM5 -70 dBc

- Channel noise 38.5 dBc

- PA noise -75 dBm/MHz

- Only additional spurious emission mask from NS\_24 is simulated. Other gating factors (ACLR, SEM, etc.) are excluded because they are handled by MPR.

- Phase noise and channel noise are only added for QAM256, following LTE 256-QAM MPR simulations.

###### Y.2.1.1.4.2 Simulation results

The following figures provide simulation results for different channel sizes and different locations for PI/2 BPSK, DFT-s-OFDM QPSK and CP-OFDM QPSK.

A graph with blue and black squares

AI-generated content may be incorrect. A graph with different colored bars

AI-generated content may be incorrect. A graph with numbers and symbols

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-1: 5MHz results at Fc=1997.5MHz

A graph with different colored bars

AI-generated content may be incorrect. A graph with different colored squares

AI-generated content may be incorrect. A graph of different colors

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-2: 5MHz results at Fc=2002.5MHz

A graph with different colored squares

AI-generated content may be incorrect. A graph with different colored bars

AI-generated content may be incorrect. A graph with different colored squares

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-3: 10MHz results at Fc=1995MHz

A graph with red and black lines

AI-generated content may be incorrect. A graph with red and black lines

AI-generated content may be incorrect. A graph of a red curve

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-4: 10MHz results at Fc=2000MHz

A graph with red and black lines

AI-generated content may be incorrect. A graph of different signals

AI-generated content may be incorrect. A graph with red and black colors

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-5: 15MHz results at Fc=2000MHz

A graph with numbers and lines

AI-generated content may be incorrect. A graph with numbers and lines

AI-generated content may be incorrect. A graph of a red and black graph

AI-generated content may be incorrect.

Figure Y.2.1.1.4.2-6: 20MHz results at Fc=1995MHz

Based on conducted simulations the follow A-MPR values and regions can be defined. The simulation results based on the A-MPR table of PC3, but some regions are different from PC3. Empty cells indicate that MPR is already enough according to our results. In some cases, region B needs to be slightly extended to cover all the allocations that need A-MPR, which also affects region C. This extension is likely needed due to the tail of the CIM3 peak. An alternative way to cover the A-MPR allocations is to decrease the upper LCRB limit of region C or create a new region. We also found that in case of PC2 the region A at 5MHz needs to be extended a bit due to regrowth of the allocation. and regions B and C need to be modified for 15MH. The reason we think why 5MHz regions for PC1 can be the same as PC3’s is because the linearity of the PC1 PAs is better due to the difference of form factors from PC2 and PC2 PAs.

**Table Y.2.1.1.4.2-1: Proposed A-MPR regions and values for PC2**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.06 | A4 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1975 < Fc ≤ 1985 | >5.4 |  | A4 |  |  |  |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 |
| 15MHz | 1972.5 < Fc ≤ 1987.5 |  | >6.84 | A1 | ≥10.8 | >1.08 ≤6.84 | A2 | <10.8 | ≤6.84 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <4.14 |  | A5 | ≥4.14  <8.64 | >1.44 | A6 |
| 20MHz | 1970 < Fc ≤ 1990 | ≥12.96 |  | A5 | <4.68 |  | A5 | ≥4.68  <12.96 | >2.16 | A6 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.58 |  | A5 | ≥5.58  <11.52 | >1.44 | A6 |
|  | | | | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| DFT-s-OFDM PI/2 BPSK | 9 | 5 | 0.5 | 2.5 | 16.5 | 11.5 |  |
| DFT-s-OFDM QPSK | 10 | 5 | 2 | 4.5 | 16.5 | 11.5 |  |
| DFT-s-OFDM 16 QAM | 11 | 5 | 2.5 | 4.5 | 16.5 | 11.5 |  |
| DFT-s-OFDM 64 QAM | 11 | 5 |  | 4.5 | 17 | 11.5 |  |
| DFT-s-OFDM 256 QAM | 11 | 5 |  |  | 17 | 11.5 |  |
| CP-OFDM QPSK | 11.5 | 5.5 | 3.5 | 5 | 17.5 | 12.5 |  |
| CP-OFDM 16 QAM | 11.5 | 5.5 | 3.5 | 5.5 | 17.5 | 12.5 |  |
| CP-OFDM 64 QAM | 11.5 | 5.5 |  | 5.5 | 17.5 | 12.5 |  |
| CP-OFDM 256 QAM | 11.5 |  |  |  | 17.5 | 12.5 |  |

##### Y.2.1.1.5 Company E (R4-2509537/Apple)

###### Y.2.1.1.5.1 Simulation assumptions

PC2 power class simulations are conducted with the common assumptions as presented below:

- Tx power: PC2 (+26dBm)

- LO placement: always in the centre of the carrier

- Regulations: Requirements from NS\_24

For the sake of completeness, the channel bandwidts and the corresponding center frequencies are summarised below:

- 5MHz: Fc=2002.5MHz, Fc=1997.5MHz, Fc=1992.5MHz

- 10MHz: Fc=2000MHz, Fc=1995MHz, Fc=1985MHz

- 15MHz: Fc=1997.5MHz, Fc=1987.5MHz

- 20MHz: Fc=1995MHz, Fc=1990MHz

###### Y.2.1.1.5.2 Simulation results

Figure Y.2.1.1.5.2-1, Figure Y.2.1.1.5.2-2 and Figure Y.2.1.1.5.2-3 present results for the 5MHz channel with the PC2 power class. The results are in line with the existing 5MHz channel A-MPR values for PC3 as defined by NS\_24. For instance, while the large allocation with CP-OFDM and PC3 would need up to 13dB A-MPR, in case of PC2 the maximum power baack-off increases up to 15dB. Nevertheless, it is worth noting that large power back-off is needed only for the full channel allocations, which are not likely to be used with the NTN deployments. Once the 5MHz channel is shifted father away from the upper band edge, one can notice an improvement in the required power back-off values. For instance, for the 5MHz channel residing at 1992.5MHz A-MPR would be need only for the large allocations, whereas small allocations do not even need MPR.

A graph of different colors

AI-generated content may be incorrect. A graph of a graph

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-1: Power back-off results for 5MHz at Fc=2002.5MHz.

A graph of different colors

AI-generated content may be incorrect. A graph of a graph

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-2: Power back-off results for 5MHz at Fc=1997.5MHz.

A graph of a graph

AI-generated content may be incorrect. A graph of a graph

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-3: Power back-off results for 5MHz at Fc=1992.5MHz.

Next, Figure Y.2.1.1.5.2-4 to Y.2.1.1.5.2-6 present the 10MHz simulation results, from which as anticipated we can see even higher power back-off required for the full channel and upper band edge allocations. In fact, the same trend can be observed further for the 15MHz and 20MHz channel bandwidths presented at figures below.

A graph of different colors

AI-generated content may be incorrect. A graph of a graph showing a waveform

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-4: Power back-off results for 10MHz at Fc=2000MHz

A graph of different colors

AI-generated content may be incorrect. A graph of a graph showing a number of colors

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-4: Power back-off results for 10MHz at Fc=1995MHz

A graph of different colors

AI-generated content may be incorrect. A graph of a graph of a spectrum

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-5: Power back-off results for 10MHz at Fc=1985MHz

A graph of a graph of a graph

AI-generated content may be incorrect. A graph of a waveform

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-6: Power back-off results for 15MHz at Fc=1997.5MHz

A graph of different colored lines

AI-generated content may be incorrect. A graph of a graph showing a spectrum of colors

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-7: Power back-off results for 15MHz at Fc=1987.5MHz

A graph of a graph with different colors

AI-generated content may be incorrect. A graph of a waveform

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-8: Power back-off results for 20MHz at Fc=1995MHz

A graph of a graph of a graph

AI-generated content may be incorrect. A graph of a waveform

AI-generated content may be incorrect.

Figure Y.2.1.1.5.2-9: Power back-off results for 20MHz at Fc=1990MHz

## Y.3 PC1.5 power class

### Y.3.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

## Y.4 PC1 power class

### Y.4.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Y.4.1.1 NS\_24N

##### Y.4.1.1.1 Company A (R4-2511269/Nokia)

###### Y.4.1.1.1.1 Simulation assumptions

The following simulation assumptions are made:

- Operating band n256 (UL 1980 MHz – 2010 MHz)

- 5MHz, 10 MHz, 15 MHz, and 20 MHz channel bandwidth

- Power class PC1

- WOLA processing

- I/Q image -28 dBc (default according to 38.101-1, Table 6.4.2.3-1) for other modulations than 256QAM

- For 256QAM the I/Q image is -33.7 dBc as in MPR simulations.

- Carrier leakage -28 dBc (default according to 38.101-1, Table 6.4.2.3-1)

- CIM3 -60 dBc

- CIM5 -70 dBc

- Channel noise 38.5 dBc

- PA noise -75 dBm/MHz

- Only additional spurious emission mask from NS\_24 is simulated. Other gating factors (ACLR, SEM, etc.) are excluded because they are handled by MPR.

- Phase noise and channel noise are only added for QAM256, following LTE 256-QAM MPR simulations.

###### Y.4.1.1.1.2 Simulation results

The following figures provide simulation results for different channel sizes and different locations for PI/2 BPSK, DFT-s-OFDM QPSK and CP-OFDM QPSK. It should be noted that power back-off is presented only for those cases when the corresponding value exceeds existing MPR margins.

A graph with numbers and symbols

AI-generated content may be incorrect. A graph with blue and black squares

AI-generated content may be incorrect.A graph with green and white text

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-1: 5MHz results at Fc=1997.5MHz

A graph of different colored squares

AI-generated content may be incorrect. A graph with different colored squares

AI-generated content may be incorrect. A graph of different colors

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-2: 5MHz results at Fc=2002.5MHz

A graph with different colored bars

AI-generated content may be incorrect. A graph of different colors

AI-generated content may be incorrect. A graph of different colors

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-3: 10MHz results at Fc=1995MHz

A graph with different colors and numbers

AI-generated content may be incorrect. A graph with different colors and numbers

AI-generated content may be incorrect. A graph of a graph with different colors

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-4: 10MHz results at Fc=2000MHz

A graph with different colors and numbers

AI-generated content may be incorrect. A graph of different colors and numbers

AI-generated content may be incorrect. A graph of a frequency

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-5: 15MHz results at Fc=2000MHz

A graph with different colors and numbers

AI-generated content may be incorrect. A graph with different colored bars

AI-generated content may be incorrect. A graph of a graph with numbers and a chart of different colors

AI-generated content may be incorrect.

Figure Y.4.1.1.1.2-6: 20MHz results at Fc=1995MHz

Based on the presented results PC1 A-MPR regions and the corresponding A-MPR values can be as summarised below in Table Y.4.1.1.1.2-1.

**Table Y.4.1.1.1.2-1: Proposed A-MPR regions and values for PC1**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | | Region B | | | Region C | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 5MHz | 1987.5 < Fc ≤ 1992.5 |  | >3.24 | A7 |  |  |  |  |  |  |
| 5MHz | 1992.5 < Fc ≤ 1997.5 |  | >3.24 | A4 |  |  |  |  |  |  |
| 5MHz | 1997.5 < Fc ≤ 2002.5 |  | >1.98 | A1 | >3.6 | >1.08 ≤1.98 | A2 | ≤3.6 | ≤1.98 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1975 < Fc ≤ 1985 | >5.4 |  | A4 |  |  |  |  |  |  |
| 10MHz | 1985 < Fc ≤ 1995 |  | >4.32 | A1 | ≥7.2 | >1.08 ≤4.32 | A2 | <7.2 | ≤4.32 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 10MHz | 1995 < Fc ≤ 2000 | ≥5.76 |  | A5 | <3.06 |  | A5 | ≥3.06  <5.76 | >1.44 | A6 |
| 15MHz | 1972.5 < Fc ≤ 1987.5 |  | >6.84 | A1 | ≥10.8 | >1.08 ≤6.84 | A2 | <10.8 | ≤6.84 | A3 |
|  |  |  |  |  |  | ≤1.08 | A6 |  |  |  |
| 15MHz | 1987.5 < Fc ≤ 1997.5 | ≥8.64 |  | A5 | <4.14 |  | A5 | ≥4.14  <8.64 | >1.44 | A6 |
| 20MHz | 1970 < Fc ≤ 1990 | ≥12.96 |  | A5 | <4.86 |  | A5 | ≥4.86  <12.96 | >2.16 | A6 |
| 20MHz | 1990 < Fc ≤ 1995 | ≥11.52 |  | A5 | <5.76 |  | A5 | ≥5.76  <11.52 | >1.44 | A6 |
|  | | | | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| DFT-s-OFDM PI/2 BPSK | 8 | 6.5 |  | 1.5 | 21.5 | 16.5 |  |
| DFT-s-OFDM QPSK | 9 | 8 |  | 3 | 21.5 | 16 |  |
| DFT-s-OFDM 16 QAM | 9.5 | 8 |  | 3.5 | 21.5 | 16 |  |
| DFT-s-OFDM 64 QAM | 9.5 | 8.5 |  | 3.5 | 21.5 | 16 |  |
| DFT-s-OFDM 256 QAM | 9.5 | 8.5 |  |  | 21.5 | 16 |  |
| CP-OFDM QPSK | 10 | 10 |  | 4 | 21.5 | 16.5 |  |
| CP-OFDM 16 QAM | 10 | 10 |  | 4 | 21.5 | 16.5 |  |
| CP-OFDM 64 QAM | 10 | 10 |  | 4 | 21.5 | 16.5 |  |
| CP-OFDM 256 QAM | 10 | 10 |  |  | 21.5 | 16.5 |  |
|  | | | | | | | |

##### Y.4.1.1.2 Company B (R4-2510521/OPPO)

###### Y.4.1.1.2.1 Simulation assumptions

Simulation assumptions are as follows:

- PC1 power class with 4Tx

- 5,10, 15 and 20MHz channels residing at the higher edge of the uplink operating band n256 and keeping 5MHz protecting guard gap between the higher edge of the channel bandwidth and the highest edge of the uplink operating band.

- CP-OFDM and DFT-s-OFDM

###### Y.4.1.1.2.2 Simulation results

Figure Y.4.1.1.2.2-1 and Figure Y.4.1.1.2.2-2 present a comparison of the NS\_24 power back-off results for 5MHz (Fc=2002.5) and 10MHz (Fc=2000MHz) under PC2 1Tx, PC1.5 2Tx and PC1 4Tx with CP-OFDM QPSK. The simulation results are based on fixed bias PA.

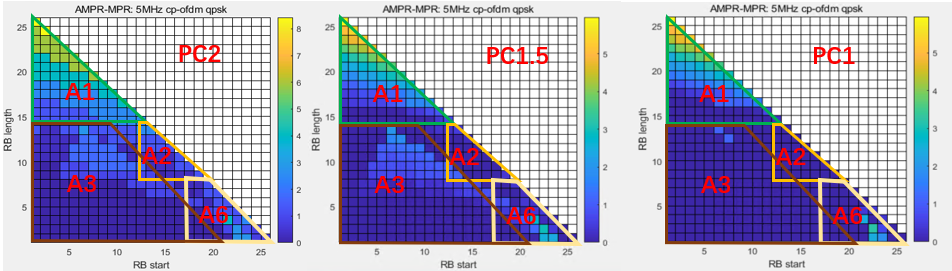
****

Figure Y.4.1.1.2.2-1 AMPR for 5MHz CP-OFDM QPSK under different power classes

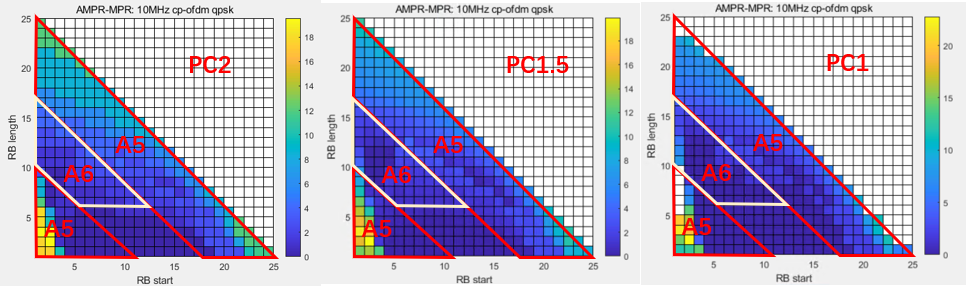
****

Figure Y.4.1.1.2.2-2 AMPR for 10MHz CP-OFDM QPSK under different power classes

In the AMPR simulation for PC2 1Tx, PC1.5 2Tx and PC1 4Tx, the same PC2 PA with fixed bias is assumed for these three power classes. From Figure Y.4.1.1.2.2-1 and Figure Y.4.1.1.2.2-2 it can be seen that:

- The PC2 and PC1.5 have the similar AMPR region frame and values due to the maximum output power of each PA for PC2 and PC1.5 is 26dBm;

- The AMPR region frame for PC1 has more margin than PC2 and PC1, since the maximum output power of each PA for PC1 is 25dBm.

Therefore, PC1 can use same AMPR regions as PC2. Table Y.4.1.1.2.2-1 proposes power back-off values, which are based on the existing PC3 regions.

Table Y.4.1.1.2.2-1: Proposed PC1 4Tx AMPR values based on PC3 A-MPR regions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/ Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| CP-OFDM QPSK | ≤ 20.5 | ≤ 16 | ≤ 16 | ≤ 15 | ≤ 31 | ≤ 23 | ≤ 10 |
| CP-OFDM 16QAM | ≤ 20.5 | ≤ 16 | ≤ 16 | ≤ 15 | ≤ 31 | ≤ 23 | ≤ 10 |
| CP-OFDM 64QAM | ≤ 20.5 | ≤ 16 | ≤ 16 | ≤ 15 | ≤ 31 | ≤ 23 | ≤ 10 |
| DFT-s-OFDM pi/2 BPSK | ≤ 18.5 | ≤ 15 | ≤ 15 | ≤ 13.5 | ≤ 31 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM QPSK | ≤ 18.5 | ≤ 15 | ≤ 15 | ≤ 13.5 | ≤ 31 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM 16QAM | ≤ 18.5 | ≤ 15 | ≤ 15 | ≤ 13.5 | ≤ 31 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM 64QAM | ≤ 18.5 | ≤ 15 | ≤ 15 | ≤ 13.5 | ≤ 31 | ≤ 22 | ≤ 9 |

If the modified regions are used as shown in Table Y.2.1.1.3.2-2, regions A1, A4 and A5 are extended, but regions A2, A3 and A8 are reduced as shown in Table Y.4.1.1.2.2-2 below

Table Y.4.1.1.2.2-2: PC1 4Tx AMPR values based on modified A-MPR regions as PC2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/ Waveform | A1 | A2 | A3 | A4 | A5 | A6 | A8 | A7 |
|  | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | | Outer |
| CP-OFDM QPSK | ≤ 20.5 | ≤ 15 | ≤ 15 | ≤ 10 | ≤ 31 | ≤ 15.5 | ≤ 23 | ≤ 10 |
| CP-OFDM 16QAM | ≤ 20.5 | ≤ 15 | ≤ 15 | ≤ 10 | ≤ 31 | ≤ 15.5 | ≤ 23 | ≤ 10 |
| CP-OFDM 64QAM | ≤ 20.5 | ≤ 15 | ≤ 15 | ≤ 10 | ≤ 31 | ≤ 15.5 | ≤ 23 | ≤ 10 |
| DFT-s-OFDM pi/2 BPSK | ≤ 18.5 | ≤ 14 | ≤ 14 | ≤ 9 | ≤ 31 | ≤ 14 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM QPSK | ≤ 18.5 | ≤ 14 | ≤ 14 | ≤ 9 | ≤ 31 | ≤ 14 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM 16QAM | ≤ 18.5 | ≤ 14 | ≤ 14 | ≤ 9 | ≤ 31 | ≤ 14 | ≤ 22 | ≤ 9 |
| DFT-s-OFDM 64QAM | ≤ 18.5 | ≤ 14 | ≤ 14 | ≤ 9 | ≤ 31 | ≤ 14 | ≤ 22 | ≤ 9 |

<Next change: Insert new Annex Z>

Annex Z:  
Power back-off simulation results for the L-band

## Z.1 PC3 power class

### Z.1.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Z.1.1.1 NS\_02N

##### Z.1.1.1.1 Company A (OPPO/R4-2510521)

##### Z.1.1.1.1.1 Simulation assumptions

Since filter rejection at the frequencies 1559-1610MHz is not a constant 10dB attenuation, but rather has a slope, it is hard to add the filter rejection without the slope factor. Thus, to evaluate the rejection effect of the filter, required power back-off is simulated under the following assumptions:

- no filter rejection is assumed;

- PC3 CP-OFDM QPSK using fixed bias PA and APT PA;

- 5, 10, 15 and 20MHz channels residing at the lowest edge of the uplink operating band n255

##### Z.2.1.1.1.2 Simulation results

For PC3 CP-OFDM QPSK using fixed bias PA:

- Power back-off 0dB is needed for 5MHz, 10MHz and 15MHz without additional filter rejection.

- Power back-off 3dB is needed for 20MHz without additional filter rejection.

For PC3 CP-OFDM QPSK using APT PA:

- Power back-off 0dB is needed for 5MHz and 10MHz without additional filter rejection.

- Power back-off 2dB for 15MHz and 10.5dB for 20MHz without additional filter rejection.

Based on the simulation results, no matter which PA model is used, the filter attenuation is needed for NS\_02N for PC3 to be able to operate within existing MPR margins.

## Z.2 PC2 power class

### Z.2.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Z.2.1.1 NS\_02N

##### Z.2.1.1.1 Company A (Qualcomm/R4-2511400)

###### Z.2.1.1.1.1 Simulation assumptionsZ.2.1.1.1.2 Simulation results

If the 10dB filter rejection is assumed for the frequency range 1559-1610MHz, then a small A-MPR is needed to meet emission requirements. As presented in Table below A-MPR is needed only for the 20MHz channel.

Table Z.2.1.1.1.2-1: Proposed A-MPR regions and values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | RBstart\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 20MHz | 1636.5 ≤ Fc ≤ 1650.5 | ≤ 0.54 | < 1.08 | A1 |
|  | > 14.4 | A1 |

|  |  |
| --- | --- |
| Modulation/Waveform | A1 |
|  | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 2.5 |
| DFT-s-OFDM QPSK | ≤ 2.5 |
| DFT-s-OFDM 16 QAM | ≤ 3 |
| DFT-s-OFDM 64 QAM | ≤ 3.5 |
| CP-OFDM QPSK | ≤ 4 |
| CP-OFDM 16 QAM | ≤ 4 |
| CP-OFDM 64 QAM | ≤ 4 |

##### Z.2.1.1.2 Company B (OPPO/R4-2510521)

###### Z.2.1.1.2.1 Simulation assumptions

Simulation assumptions are as follows:

- PC2 power class

- 10, 15 and 20MHz channels residing at the lowest edge of the uplink operating band n255

- CP-OFDM and DFT-s-OFDM

- both cases, with and without 10dB filter attenuation are considered

###### Z.2.1.1.2.2 Simulation results

To check the effect of filter rejection, power back-off results are presented for the 10, 15 and 20MHz channels with PC2 CP-OFDM QPSK using APT PA w/o filter rejection and with a constant 10 dBfilter attenuation at the frequencies 1559-1610 MHz. In the following figures, A-MPR and "A-MPR – MPR" simulation results are provided separately, i.e. "A-MPR – MPR" figres show the difference between required power back-off and existing MPR margings.

A screenshot of a graph

AI-generated content may be incorrect.

Figure Z.2.1.1.2.2-1: Power back-off change for 10MHz based on a constant 10dB filter rejection using APT PA

From Figure Z.2.1.1.2.2-1 for the 10MHz channel it can be seen that:

* For PC2 without filter isolation, the AMPR region starts at LCRB>16RB and the largest AMPR value is around 4.5dB and even larger.
* For PC2 with 10dB filter isolation, we can see that required power back-off is smaller than the existing MPR margin, i.e. there is no need to define A-MPR for 10MHz channel bandwidth.

A screenshot of a graph

AI-generated content may be incorrect.

Figure Z.2.1.1.2.2-2: Power back-off change for 15MHz based on a constant 10dB filter rejection using APT PA

From Figure Z.2.1.1.2.2-2 for the 15MHz channel it can be seen that:

* The A-MPR regions with the 10dB filter isolation becomes smaller than the A-MPR regions without filter isolation, but the overall required power back-off is still larger than MPR.
* For PC2 with the 10dB filter isolation, the AMPR region starts building at LCRB>30RB, whereupon the largest power back-off is larger than 3.5 dB.

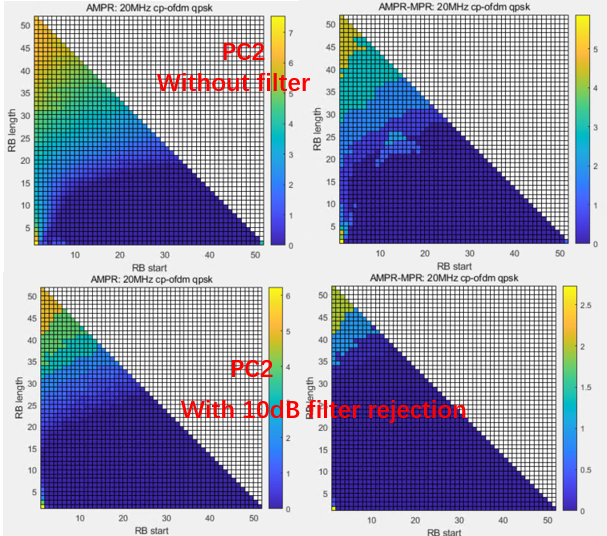


Figure Z.2.1.1.2.2-3: Power back-off change for 20MHz based on a constant 10dB filter rejection using APT PA

From Figure Z.2.1.1.2.2-3 for the 20MHz channel it can be seen that:

* The A-MPR region with the 10dB filter isolation becomes smaller than the AMPR region without filter isolation, but the required power back-off is larger than MPR.
* For PC2 with the 10dB filter isolation, the AMPR region starts at LCRB>34RB, and the required power back-off is larger than 6dB.

In addition to the above results, Figure Z.2.1.1.2.2-4 and Z.2.1.1.2.2-5 below presents additional results for the CP-OFDM and DFT-s-OFDM for the 15MHz channel with different modulations.

A graph of a triangle

AI-generated content may be incorrect.

Figure Z.2.1.1.2.2-4: Power back-off for 15MHz CP-OFDM QPSK, 16QAM and 64QAM.

A graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of

AI-generated content may be incorrect.

Figure Z.2.1.1.2.2-5: Power back-off for 15MHz DFT-s-OFDM PI/2 BPSK, QPSK, 16QAM and 64QAM.

From Figure Z.2.1.1.2.2-4 and Figure Z.2.1.1.2.2-5 it can be seen that:

* The A-MPR regions and the A-MPR values are almost the same for different modulations for both of CP-OFDM and DFT-s-OFDM.

Considering presented results and the 10dB filter rejection, PC2 A-MPR may look as presented in the table below.

Table Z.2.1.1.2.2-1: Proposed A-MPR regions and values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | RBstart\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 15MHz | 1634 < Fc ≤ 1649 |  | >10.8 | A1 |
| 20MHz | 1636.5 < Fc ≤ 1650.5 |  | >10.8 | A2 |
| <0.54 | <1.8 |

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | A1 | A2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 0.5 | ≤ 3 |
| QPSK/16QAM/64QAM | ≤ 3.5 | ≤ 6 |
| CP-OFDM | QPSK/16QAM/64QAM | ≤ 4 | ≤ 6.5 |

##### Z.2.1.1.3 Company C (LGE/R4-2510776)

###### Z.2.1.1.3.1 Simulation assumptions

Simulation assumptions are as follows:

- PC2 power class

- 5, 10, 15 and 20MHz channels in the frequency range of 1629-1654MHz

- DFT-s-OFDM QPSK

- both cases, with and without 10dB filter attenuation are considered

###### Z.2.1.1.3.2 Simulation results

Table below presents required power back-off values for two cases with and without 10dB filter rejection. According to the simulation results, there is only one case without the 10dB filter at 20 MHz bandwidth and center frequency of 1636.5MHz (RBstart: 0, LCRB: 51) requires A-MPR driven by the NS\_02N limit. In all other cases, power back-off is determined by factors other than NS\_02N, such as ACLR or SEM. Furthermore, when the 10 dB filtering is applied, none of the scenarios require A-MPR driven by NS\_02N.

Table Z.2.1.1.3.2-1: Summary of A-MPR simulations for DFT-s-OFDM QPSK.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Channel bandwidth | Frequency range | (RB\_start, LCRB) | | | |
| 5MHz | 1629 < Fc ≤ 1654 | (0,11) | (0,1) |  |  |
| PC2 W/O 10dB |  | 0 | 1.47 |  |  |
| PC2 W 10dB |  | 0 | 1.47 |  |  |
| 10MHz | 1631.5 < Fc ≤ 1641.5 | (0,24) | (0,1) |  |  |
| PC2 W/O 10dB |  | 0 | 2.09 |  |  |
| PC2 W 10dB |  | 0 | 2.09 |  |  |
| 10MHz | 1641.5 < Fc ≤ 1655.5 | (0,24) | (0,1) |  |  |
| PC2 W/O 10dB |  | 0 | 2.03 |  |  |
| PC2 W 10dB |  | 0 | 2.03 |  |  |
| 15MHz | 1634 < Fc ≤ 1649 | (0,38) | (0,1) |  |  |
| PC2 W/O 10dB |  | 0.31 | 4.03 |  |  |
| PC2 W 10dB |  | 0.31 | 4.03 |  |  |
| 15MHz | 1649 < Fc ≤ 1653 | (0,38) | (0,1) |  |  |
| PC2 W/O 10dB |  | 0.34 | 4.16 |  |  |
| PC2 W 10dB |  | 0.34 | 4.16 |  |  |
| 20MHz | 1636.5 < Fc ≤ 1640.5 | (0,19) | (0,51) | (0,1) | (50,1) |
| PC2 W/O 10dB |  | 0 | 1.19 | 3.69 | 3.28 |
| PC2 W 10dB |  | 0 | 0.38 | 3.69 | 3.28 |
| 20MHz | 1640.5 < Fc ≤ 1650.5 | (0,38) | (0,1) | (0,1) | (50,1) |
| PC2 W/O 10dB |  | 0 | 0.38 | 3.72 | 3.09 |
| PC2 W 10dB |  | 0 | 0.38 | 3.72 | 3.09 |

Additionally, further simulations are conducted as shown below to determine the required A-MPR region for the 20MHz channel bandwidth. Accordin to these results A-MPR would be needed for scenarios from (0,51) to (0,45).

Table Z.2.1.1.3.2-2: Further results for the 20MHz channel at 1636.5 < Fc ≤ 1640.5.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel | (RB start, LCRB) | | | | | | | |
| 20MHz | (0,51) | (0,49) | (0,47) | (0,45) | (0,43) | (0,41) | (0,39) | (0,37) |
| DFT-s-OFDM QPSK | 1.19 | 0.97 | 0.72 | 0.41 | 0.34 | 0.38 | 0.41 | 0.41 |

Based on the presented results potential A-MPR definitions may look as follows.

Table Z.2.1.1.3.2-3: Proposed A-MPR regions and values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A | | |
|  |  | RBend\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 20MHz | 1636.5 < Fc ≤ 1640.5 |  | >16.2 | A1 |

|  |  |
| --- | --- |
| Modulation/Waveform | A1 |
|  | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | 1.19 |
| DFT-s-OFDM QPSK | 1.19 |
| DFT-s-OFDM 16 QAM | 1.41 |
| DFT-s-OFDM 64 QAM | 1.44 |
| CP-OFDM QPSK | 1.91 |
| CP-OFDM 16 QAM | 1.94 |
| CP-OFDM 64 QAM | 1.91 |

##### Z.2.1.1.4 Company D (Apple/R4-2509536)

###### Z.2.1.1.4.1 Simulation assumptions

Simulation assumptions are as follows:

- Tx power: PC2 (+26dBm)

- LO placement: always in the centre of the carrier

- Regulations: Requirements from NS\_02N

- 10dB filter rejection is assumed

For the sake of brevity, simulations are considered for the 5, 10, 15 and 20MHz channel bandwidths, whereupon the corresponding channel is always located at the lower edge of the n255 band:

- 5MHz: Fc=1629MHz

- 10MHz: Fc=1631.5MHz

- 15MHz: Fc=1634MHz

- 20MHz: Fc=1636.5MHz

###### Z.2.1.1.4.2 Simulation results

According to the preliminary simulation results, no additional power back-off is needed for the 5 and 10MHz channel bandwidths. Thus, the corresponding figures for these channel bandwidths will not be presented.

As for the 15 and 20MHz channels, some power back-off is needed as can be seen from figures below. Nevertheless, the 15MHz channel power back-off is quite marginal and is within the existing MPR margins. As for the 20MHz channel, it naturally experiences higher power back-off, which in some cases reaches existing MPR margins, especially for the full channel and single RB edge allocations.

A graph of a graph with different colors

AI-generated content may be incorrect. A graph with a number of colors

AI-generated content may be incorrect.

Figure Z.2.1.1.4.2-1: Power back-off results for 15MHz at Fc=1634MHz.

A graph with numbers and lines

AI-generated content may be incorrect. A graph with different colored triangles

AI-generated content may be incorrect.

Figure Z.2.1.1.4.2-2: Power back-off results for 20MHz at Fc=1636.5MHz.

Based on the presented results it is not likely that 15MHz channel needs A-MPR. As for the 20MHz channel, small A-MPR can be considered for large allocations.

## Z.3 PC1.5 power class

### Z.3.1: General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Z.3.1.1 NS\_02N

##### Z.3.1.1.1 Company B (OPPO/ R4-2510521)

###### Z.3.1.1.1.1 Simulation assumptions

The following simulation assumptions are used:

- PC1.5 power class with 2Tx

- 10, 15 and 20MHz channels residing at the lowest edge of the uplink operating band n255

- CP-OFDM and DFT-s-OFDM

- without 10dB filter attenuation

###### Z.3.1.1.1.2 Simulation results

Figure Z.3.1.1.1.2-1 and Figure Z.3.1.1.1.2-2 show the AMPR and AMPR-MPR simulation results for CP-OFDM and DFT-s-OFDM with QPSK for 15MHz and 20MHz sepatately.

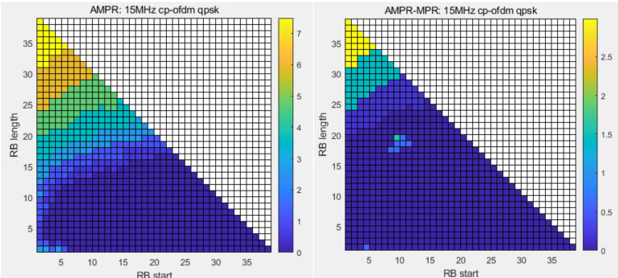


Figure Z.3.1.1.1.2-1: Power back-off change for 15MHz without filter rejection using APT PA

A screenshot of a graph

AI-generated content may be incorrect.

Figure Z.3.1.1.1.2-2: Power back-off change for 20MHz without filter rejection using APT PA

From Figure Z.3.1.1.1.2-1 for the 15MHz channel it can be seen that:

* For PC1.5 without filter isolation, the AMPR region is at LCRB>15RB, and the largest AMPR is almost 7.5 dB.

From Figure Z.3.1.1.1.2-2 for the 20MHz channel we can find that:

* For PC1.5 without filter isolation, the largest AMPR is almost 9.5 dB for the AMPR region at LCRB>15RBs. And the AMPR region of LCRB<15RBs and RBstart<3RBs.

In additional, due to time limitation, we didn’t do the simulation with 10dB filter isolation totally, we just simulated the AMPR for the point of (RBstart=0, LCRB=52) with 10dB filter isolation, the AMPR with 10dB filter isolation is smaller 1.5dB than the AMPR value without filter isolation.

If the 10dB filter rejection is assumed for the frequency range 1559-1610MHz, PC1.5 A-MPR presents in the table below:

Table Z.3.1.1.1.2-1: Proposed A-MPR regions and values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | RBstart\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 20MHz | 1636.5 ≤ Fc ≤ 1650.5 | ≤ 0.54 | < 1.08 | A1 |
|  | > 14.4 | A1 |
|  | > 10.8, ≤ 14.4 | A2 |
| 15MHz | 1634 ≤ Fc ≤ 1645 |  | > 10.8 | A2 |

|  |  |  |
| --- | --- | --- |
| Modulation/Waveform | A1 | A2 |
|  | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 8 | ≤ 4 |
| DFT-s-OFDM QPSK | ≤ 8 | ≤ 4 |
| DFT-s-OFDM 16 QAM | ≤ 8 | ≤ 4 |
| DFT-s-OFDM 64 QAM | ≤ 8 | ≤ 4 |
| CP-OFDM QPSK | ≤ 8 | ≤ 6 |
| CP-OFDM 16 QAM | ≤ 8 | ≤ 6 |
| CP-OFDM 64 QAM | ≤ 8 | ≤ 6 |

## Z.4 PC1 power class

### Z.4.1 General aspects

NOTE: The purpose of the section is to capture general aspects, such as considered UE RF architectures, assumptions, considered regulations, etc.

#### Z.4.1.1 NS\_02N

##### Z.4.1.1.1 Company A (Qualcomm/R4-2511400)

###### Z.4.1.1.1.1 Simulation assumptionsZ.4.1.1.1.2 Simulation results

If the 10dB filter rejection is assumed for the frequency range 1559-1610MHz, then a small A-MPR is needed to meet emission requirements. As presented in Table below A-MPR is needed only for the 20MHz channel.

Table Z.4.1.1.1.2-1: Proposed A-MPR regions and values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | RBstart\*12\*SCS  MHz | LCRB\*12\*SCS  MHz | A-MPR |
| 20MHz | 1636.5 ≤ Fc ≤ 1650.5 | ≤ 0.54 | < 1.08 | A1 |
|  | > 14.4 | A1 |
|  | > 10.8, ≤ 14.4 | A2 |
| 15MHz | 1634 ≤ Fc ≤ 1645 |  | > 10.8 | A2 |

|  |  |  |
| --- | --- | --- |
| Modulation/Waveform | A1 | A2 |
|  | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | ≤ 5 | ≤ 3 |
| DFT-s-OFDM QPSK | ≤ 5 | ≤ 3 |
| DFT-s-OFDM 16 QAM | ≤ 5 | ≤ 3.5 |
| DFT-s-OFDM 64 QAM | ≤ 5.5 | ≤ 4 |
| CP-OFDM QPSK | ≤ 6 | ≤ 4 |
| CP-OFDM 16 QAM | ≤ 6 | ≤ 4 |
| CP-OFDM 64 QAM | ≤ 6 | ≤ 4 |

<End of Changes>

<Please find above Annex X in the zip folder, and rename it accordingly >