**3GPP TSG-RAN WG4 Meeting # 110 R4-2402856**

**Athens, Greece, 26th February – 1st March 2024**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | **0001** | **rev** | **-** | **Current version:** | **0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | CR to TR 36.764 to introduce IoT NTN Extended L-band | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Inmarsat, Viasat | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IoT\_NTN\_extLband-Core | | | | |  | ***Date:*** | | | 2024-02-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Resubmit the endorsed draft CR R4-2315677. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To introduce the 3GPP specifications for the Extended L-band into the spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | the 3GPP specifications for the Extended L-band is missing. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4, 5, 7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

# << Start of change >>

# 4 Background

In 3GPP RAN#99 meeting, for fulfilling market demand, the new spectrum WI to add support for a new IoT NTN band with the DL part on the S-band (2500MHz) and the UL part on the L-band (1600MHz) was agreed. Additionally, another new IoT NTN spectrum WI for the Extended L-band (DL 1518-1525 MHz, UL 1668-1675 MHz) was agreed as well. Introduction and specification of requirements for more NTN IoT bands is expected and can be requested if necessary.

## << End of change >>

## << Start of change >>

# 5 Common band agnostic aspects

## 5.1 System parameters

### 5.1.1 Operating bands

IoT NTN operation is designed in the operating bands defined in Table 5.1.1-1.

Table 5.1.1-1 E-UTRA operating bands for IoT NTN operation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating band BS receive UE transmit | | | Downlink (DL) operating band BS transmit  UE receive | | | Duplex Mode |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| 254 | 1610 MHz | - | 1626.5 MHz | 2483.5 MHz | - | 2500 MHz | FDD |
| 253 | 1668 MHz | - | 1675 MHz | 1518 MHz | - | 1525MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from 256 | | | | | | | |

### 5.1.2 Channel arrangements

#### 5.1.2.1 Channel arrangement for category M1

Table 5.1.2.1-1: E-UTRA channel numbers

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Operating  Band | ΔFRaster (kHz) | Downlink | | | Uplink | | |
| FDL\_low (MHz) | NOffs-DL | Range of NDL  (First – <Step size> – Last) | FUL\_low (MHz) | NOffs-UL | Range of NUL  (First – <Step size> – Last) |
| 254 | 100 | 2483.5 | 228571 | 228571 –<1>- 228735 | 1610 | 261339 | 261339 –<1>- 261503 |
| 253 | 100 | 1668 | 228501 | 228501-<1>-228570 | 1518 | 261269 | 261269 -<1>-261338 |
| NOTE 1: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7 channel numbers at the lower operating band edge and the last 6 channel numbers at the upper operating band edge shall not be used for channel bandwidth of 1.4 MHz. | | | | | | | |

NOTE: In addition to the above, the following was agreed during RAN4#108-bis:

* + The need for additional flexibility in channel raster for IoT NTN LTE bands has been identified, especially to accommodate future deployments of NB-IoT NTN and eMTC NTN together with NR NTN around existing services, taking into account possible guard bands for protection of other services, Doppler, and for deployment within the same SAN (i.e. same FFT). This issue could be further discussed independently of band 253, with more general applicability to all IoT NTN LTE bands.
    - Capture this aspect in the TR.
    - FFS whether to capture a note in the specification

Table 5.1.2.1-2: Default UE TX-RX frequency separation

| E-UTRA Operating Band | TX – RX  carrier centre frequency separation |
| --- | --- |
| 254 | 873.5 MHz |
| 253 | -150 MHz |

NOTE: As highlighted in RAN4#108-bis, based on operator input, there is a strong desire to consider flexible TX-RX separation for the band itself, and moreover for NTN FR1 bands, provided the frequency separation is sufficiently large.

The following conclusion was reached during RAN4#109:

**Conclusion:** Stop discussion on this issue in this WI.

## << End of change >>

## << Start of change >>

# 7 FDD band 253 (ext L band)

## 7.1 Regulation

NOTE: The purpose of this section is to collect information from existing regulatory documents concerning regulatory rules applicable to this NTN extended L band.

NOTE: As per agreement in RAN4#108, the following assumption is captured:

For the time being, re-use TN-NTN coexistence assumptions from TR 38.863, which would yield a total separation distance of 5250 m from TN BS site and NTN UE, at least for low-gain land-based NTN UE, compatible with smartphone and IoT use cases.

### 7.1.1 ETSI EN 301 681

ETSI EN 301 681 is applicable to Mobile Earth Stations (SES) with both transmit and receive capabilities for operation in Satellite Personal Communications Networks (S-PCN) in any combination of all or any part of the Mobile Satellite Service (MSS) frequency bands sub-band 1 and sub-band 2 defined in table 1.

**Table 1: Mobile Satellite Service (MSS) frequency band**

|  |  |  |
| --- | --- | --- |
| **Sub-band** | **Transmission path** | **MSS frequency band** |
| 1 | MESs transmit 1 | 1 626,5 MHz to 1 660,5 MHz |
| MESs receive 1 | 1 525 MHz to 1 559 MHz |
| 2 | MESs transmit 2 | 1 668,0 MHz to 1 675,0 MHz |
| MESs receive 2 | 1 518,0 MHz to 1 525,0 MHz |

Unwanted emissions from Mobile Earth Stations (LMESs) outside the band 1 626,5 MHz to 1 660,5 MHz and outside the band 1 668 MHz to 1 675 MHz shall be below the following limits.

Unless otherwise stated the specification in this clause shall apply to all types of MESs notwithstanding their transmitting capabilities within the frequency bands as defined in table 1:

1. For MES that are capable of transmitting within only the sub-band 1 frequency band as defined in table 1, the maximum EIRP spectral density of the unwanted emissions from the MES outside the band 1 626,5 MHz to 1 660,5 MHz shall not exceed the limits in either table 3 or table 3a. The applicant shall declare which alternative shall be used.
2. For MES that are capable of transmitting within only sub-band 2 frequency band or within both the sub-band 1 and sub-band 2 frequency bands, the maximum EIRP spectral density of the unwanted emissions from the MES outside the bands 1 626,5 MHz to 1 660,5 MHz and 1 668,0 MHz to 1 675,0 MHz shall not exceed the limits in table 3a.

**Table 3: Unwanted emissions outside the band 1 626,5 MHz to 1 660,5 MHz for MES only capable of transmitting within sub-band 1 frequency band as defined in table 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency (MHz)** | **Carrier - on state** | | |
| **EIRP**  **(dBW)** | **Measurement**  **bandwidth** | **Measurement method**  **(see note 6)** |
| 30 to 1 000 | -66 | 100 kHz | Peak Hold |
| 1 000 to 1 559 | -61 | 1 MHz | Average |
| 1 559 to 1 605,0 | -70 | 1 MHz  (see note 3) | Average (see note 2) |
| 1 605,0 to 1 612,5 | -70 to -58,5  (see note 4) | 1 MHz  (see note 3) | Average |
| 1 612,5 to 1 616,5 | -55 to -50  (see note 4) | 1 MHz | Average |
| 1 616,5 to 1 621,5 | -50 to -46  (see note 4) | 1 MHz | Average |
| 1 621,5 to 1 624,5 | -60 | 30 kHz | Average |
| 1 624,5 to 1 625,0 | -60 to -57,5  (see notes 4, 5, 7) | 30 kHz | Average |
| 1 625,0 to 1 625,125 | -57,5 to -57,2  (see notes 4, 5, 7) | 30 kHz | Average |
| 1 625,125 to 1 625,8 | -57,2 to -50  (see notes 4, 5, 7) | 30 kHz | Average |
| 1 625,8 to 1 626,0 | -50 to -47  (see notes 4, 5, 7) | 30 kHz | Average |
| 1 626,0 to 1 626,2 | -47 to -40  (see notes 4, 5, 7) | 30 kHz | Average |
| 1 626,2 to 1 626,5 | -40  (see notes 5, 7) | 30 kHz | Average |
| 1 626,5 to 1 660,5 | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE |
| 1 660,5 to 1 662,5 | The levels in table 4a shall apply from 1 660,5 MHz to 1 662,5 MHz | | |
| 1 662,5 to 1 665,5 | -60 | 30 kHz | Average |
| 1 665,5 to 1 670,5 | -60 | 100 kHz | Average |
| 1 670,5 to 1 680,5 | -60 | 300 kHz | Average |
| 1 680,5 to 1 690,5 | -60 | 1 MHz | Average |
| 1 690,5 to 2 250 | -60 | 3 MHz | Average |
| 2 250 to 12 750  (see note 1) | -60 | 3 MHz | Peak Hold |
| NOTE 1: In the band 3 253,0 MHz to 3 321,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -38 dBW. Elsewhere in this band the power limit in table 3 shall be applied.  In each of the bands 4 879,5 MHz to 4 981,5 MHz, 6 506,0 MHz to 6 642,0 MHz and 8 132,5 MHz to 8 302,5 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3 shall be applied.  NOTE 2: The average measurement method defined in clause 5.2.2.3 shall apply except that an averaging period of 20 ms shall be used in the sub-band 1 573,42 MHz to 1 580,42 MHz.  NOTE 3: Measurement bandwidths less than 1 MHz are allowable provided the power in the narrower bandwidth is integrated over 1 MHz.  NOTE 4: Linearly interpolated in dBW vs. Frequency.  NOTE 5: The power limits specified in the band 1 624,5 MHz to 1 626,5 MHz require further study. This study is important to determine whether less stringent limits may enhance spectrum efficiency and utilization immediately above 1 626,5 MHz.  NOTE 6: Peak Hold and Average measurements shall be performed as specified in clauses 5.2.2.2 and 5.2.2.3.  NOTE 7: For systems employing CDMA, the EIRP limits shall be decreased by 10 log (N) dB, where N is the maximum number of MESs in the receive beam of the satellite to which these MESs are communicating and which are expected to transmit simultaneously in the same frequency band within  that same beam. This number shall be declared by the manufacturer (N = 1 in a TDMA system). | | | |

**Table 3a: Unwanted emissions outside the bands 1 626,5 MHz to 1 660,5 MHz and 1 668,0 MHz to 1 675,0 MHz for MES capable of transmitting within all or any part of sub-band 1 and sub-band 2 frequency bands as defined in table 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency (MHz)** | **Carrier - on state** | | |
| **EIRP (dBW)** | **Measurement bandwidth** | **Measurement method (see note 8)** |
| 30 to 1 000 | -66 | 100 kHz | Peak Hold |
| 1 000 to 1 559 | -61 | 1 MHz | Average |
| 1 559 to 1 605,0 | -70 | 1 MHz  (see note 5) | Average (see note 2) |
| 1 605,0 to 1 612,5 | -70 to -58,5  (see note 6) | 1 MHz  (see note 5) | Average |
| 1 612,5 to 1 616,5 | -55 to -50  (see note 6) | 1 MHz | Average |
| 1 616,5 to 1 621,5 | -50 to -46  (see note 6) | 1 MHz | Average |
| 1 621,5 to 1 624,5 | -60 | 30 kHz | Average |
| 1 624,5 to 1 625,0 | -60 to -57,5  (see notes 6, 7, 9) | 30 kHz | Average |
| 1 625,0 to 1 625,125 | -57,5 to -57,2  (see notes 6, 7, 9) | 30 kHz | Average |
| 1 625,125 to 1 625,8 | -57,2 to -50  (see notes 6, 7, 9) | 30 kHz | Average |
| 1 625,8 to 1 626,0 | -50 to -47  (see notes 6, 7, 9) | 30 kHz | Average |
| 1 626,0 to 1 626,2 | -47 to -40  (see notes 6, 7, 9) | 30 kHz | Average |
| 1 626,2 to 1 626,5 | -40  (see notes 7, 9) | 30 kHz | Average |
| 1 626,5 to 1 660,5 | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE |
| 1 660,5 to 1 662,5 | note 1 | note 1 | note 1 |
|  |  | | |
| 1 662,5 to 1 666,0 | -55 | 30 kHz | Average |
| 1 666,0 to 1 668,0 | note 2 | note 2 | note 2 |
|  |  | | |
| 1 668,0 to 1 675,0 | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE |
| 1 675,0 to 1 677,0 | note 2 | note 2 | note 2 |
|  |  | | |
| 1 677,0 to 1 680,0 | -60 | 30 kHz | Average |
| 1 680,0 to 1 685,0 | -60 | 100 kHz | Average |
| 1 685,0 to 1 695,0 | -60 | 300 kHz | Average |
| 1 695,0 to 1 705,0 | -60 | 1 MHz | Average |
| 1 705,0 to 2 250 | -60 | 3 MHz | Average |
| 2 250 to 12 750  (see note 3) | -60 | 3 MHz | Peak Hold |

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency (MHz)** | **Carrier - on state** | | |
| **EIRP**  **(dBW)** | **Measurement**  **bandwidth** | **Measurement method**  **(see note 8)** |
| NOTE 1: For an MES transmitting in sub-band 1 (as defined in table 1) the limits defined in table 4a shall apply for the band 1 660,5 MHz to 1 662,5 MHz. For an MES transmitting in sub-band 2 (as defined in table 1) a limit of -55 dBW in 30 kHz shall apply for the band 1 660,5 MHz to 1 662,5 MHz.  NOTE 2: For an MES transmitting in sub-band 2 (as defined in table 1) the limits defined in table 4a shall apply for the bands 1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz. For an MES transmitting in sub-band 1 (as defined in table 1) a limit of -55 dBW in 30 kHz shall apply for the bands  1 666,0 MHz to 1 668,0 MHz and 1 675,0 MHz to 1 677,0 MHz.  NOTE 3: In the bands 3 253,0 MHz to 3 321,0 MHz and 3 336,0 MHz to 3 350,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -38 dBW. Elsewhere in this band the power limit in table 3a shall be applied.  In the bands 4 879,5 MHz to 4 981,5 MHz and 5 004,0 MHz to 5 025,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied.  In the bands 6 506,0 MHz to 6 642,0 MHz and 6 672,0 MHz to 6 700,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied.  In the bands 8 132,5 MHz to 8 302,5 MHz and 8 340,0 MHz to 8 375,0 MHz the maximum EIRP in one, and only one, 3 MHz measurement bandwidth shall not exceed -48 dBW. Elsewhere in this band the power limit in table 3a shall be applied.  NOTE 4: The average measurement method defined in clause 5.2.2.3 shall apply except that an averaging period of 20 ms shall be used in the sub-band 1 573,42 MHz to 1 580,42 MHz.  NOTE 5: Measurement bandwidths less than 1 MHz are allowable provided the power in the narrower bandwidth is integrated over 1 MHz.  NOTE 6: Linearly interpolated in dBW vs. Frequency.  NOTE 7: The power limits specified in the band 1 624,5 MHz to 1 626,5 MHz require further study. This study is important to determine whether less stringent limits may enhance spectrum efficiency and utilization immediately above 1 626,5 MHz.  NOTE 8: Peak Hold and Average measurements shall be performed as specified in clauses 5.2.2.2 and 5.2.2.3.  NOTE 9: For systems employing CDMA, the EIRP limits shall be decreased by 10 log (N) dB, where N is the maximum number of MESs in the receive beam of the satellite to which these MESs are communicating and which are expected to transmit simultaneously in the same frequency band within that same beam. This number shall be declared by the manufacturer (N = 1 in a TDMA system). | | | |

**Table 4a: Maximum unwanted emissions in the bands 1 626,5 MHz to 1 660,5 MHz and 1 660,5 MHz to 1 662,5 MHz caused by S-PCN MESs transmitting in the band 1 626,5 MHz to 1 660,5 MHz; and maximum unwanted emissions in the bands 1 666,0 MHz to 1 668,0 MHz, 1 668,0 MHz to 1 675,0 MHz and 1 675,0 MHz to 1 677,0 MHz caused by S-PCN MESs transmitting in the band 1 668,0 MHz to 1 675,0 MHz**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Carrier-on state** | | |
| **offset (kHz)**  **(see note 1)** | **EIRP (dBW)**  **(see note 2)** | **Measurement bandwidth**  **(kHz)** | **Measurement method** |
| 0 to 25 | 0 to -15 | 3 | Average |
| 25 to 125 | -15 to -50 | 3 | Average |
| 125 to 425 | -50 | 3 | Average |
| 425 to 1 500 | -50 to -65 | 3 | Average |
| 1 500 to 36 000 | -55 | 30 | Average |
| NOTE 1: Frequency offset is determined from the edge of the nominated bandwidth. NOTE 2: Linearly interpolated in dBW vs. Frequency offset. | | | |

**Table 4b: Maximum unwanted emissions in the bands 1 626,5 MHz to 1 660,5 MHz caused by S-PCN MESs transmitting in the band 1 626,5 MHz to 1 660,5 MHz; and maximum unwanted emissions in the bands 1 668,0 MHz to 1 675,0 MHz caused by S-PCN MESs transmitting in the band 1 668,0 MHz to 1 675,0 MHz**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency offset**  **(kHz)**  **(see notes 1 and 3)** | **Carrier-on state** | | |
| **EIRP**  **(dBW)**  **(see note 2)** | **Measurement bandwidth**  **(kHz)** | **Measurement method** |
| 0 to 25 | 0 to -15 | 3 | Average |
| 25 to 55 | -15 to -25  (see note 4) | 3 | Average |
| 55 to AB | -25  (see note 4) | 3 | Average |
| AB to (AB + 0,35 x B3dB) | -25 to -40  (see note 4) | 3 | Average |
| (AB + 0,35 x B3dB) to CD | -40 | 3 | Average |
| CD to (CD + 0,25 x B3dB) | -40 to -50 | 3 | Average |
| (CD + 0,25 x B3dB) to EF | -50 | 3 | Average |
| EF to 1 500 | -50 to -65 | 3 | Average |
| 1 500 to 36 000 | -55 | 30 | Average |
| NOTE 1: Frequency offset is determined from the edge of the nominated bandwidth.  NOTE 2: Linearly interpolated in dBW vs. Frequency offset.  NOTE 3: The parameters AB, CD, EF are defined below.  NOTE 4: The limit of -25 dBW in this table is determined on the assumption that the adjacent channel interference results from a single interferer. This limit shall apply to MESs that are designed for operation in a network where the occurrence of two (or more) interferers, all transmitting with the maximum permitted level of unwanted emissions, does not exceed 0,1 % of the time; otherwise a limit of -30 dBW shall apply. | | | |

The parameters AB, CD and EF are defined as a proportion of the 3 dB Bandwidth as follows:

* AB = (55) or (100 % of the B3dB), whichever is the greater; • CD = (95) or (200 % of the B3dB), whichever is the greater;
* EF = (125) or (300 % of the B3dB), whichever is the greater.

Each MES shall have a unique MES Identification Code (MIC) within its S-PCN.

It shall not be possible for the user to alter the MIC using any normally accessible procedure.

The MES shall be capable of transmitting its MES Identification Code upon reception of an appropriate NCF command addressed to it.

To protect the radio astronomy service in the 1 660 MHz to 1 660,5 MHz band and the 1 668,0 MHz to 1 670,0 MHz band from emissions produced by MESs the transmissions in these frequency bands shall be capable of being disabled in the vicinity of RA stations recorded in the ITU Master International Frequency Register.

### 7.1.2 ECC Report 263

The report has established the technical characteristics of the IMT and the MSS system and determined the relevant scenarios. It has also determined the appropriate propagation models for these scenarios according to the environment where the equipment is used and further the protection criteria has been established.

The report has, from these characteristics and parameters, developed an MCL analysis with the resulting required separation distances for the 3 different frequency separations (1 MHz, 3 MHz and 6 MHz frequency separations).

The frequency separation allocation is not addressed by this report.

Further the report makes use of the MCL to establish interference arising in the first MES channel above the 3 different frequency separations investigated for an area with IMT coverage.

The results of the simulations show that there will be some interference irrespective of the selected frequency separation.

MES terminals currently on the market which have characteristics similar to those selected for this study, may experience interference problems because of the susceptibility of the MES receiver to the wanted signals from the IMT systems. As there are currently no available technical characteristics which outline at what frequency this effect starts to occur, blocking may also be experienced from IMT transmitters more than 6 MHz away into the IMT band below 1518 MHz.

Based on the findings of this report, the following mitigation techniques could further improve the compatibility between IMT and MSS around 1518 MHz:

* The interference due to IMT OOB emissions can be reduced by improved filtering on the IMT base station.
* The interference due to blocking can be reduced by improving the MES resilience to LTE blocking signals in the adjacent band.
* Either adding location based frequency allocation to MSS to avoid the use the lower couple of MHz and/or, implementing interference avoidance which would in addition allow for a better frequency utilisation of the lower part of the 1518-1559 MHz frequency band for MSS. The feasibility and impact of these techniques have not been assessed.

The following values have been used to examine the impact of enhanced MES receiver performance.

Table 8: Assumed blocking level for enhanced MES receivers

|  |  |
| --- | --- |
| Frequency separation  between channel edges | Interference level  (at output of receiving antenna) |
| 1 MHz | –55 to –45 dBm |
| 3 MHz | –35 to –30 dBm |
| 6 MHz | –30 to –25 dBm |

Based on the final results of its compatibility studies, it is concluded that:

* the minimum in-band blocking characteristic for land mobile earth stations receivers from a 5 MHz broadband signal interferer (LTE) operating below 1518 MHz shall be −30dBm above 1520 MHz (Note: when the MES operates above 1520 MHz),
* the base station unwanted emission limits EIRP for a broadband signal interferer (LTE) operating below 1518 MHz shall be −30dBm/MHz above 1520 MHz. This figure is 10 dB more stringent than ECC Decision (13)03 due to a different service in the adjacent band.

It is noted that the IMT block ends at 1517 MHz.

## 7.2 UE requirements

### 7.2.1 UE transmitter characteristics

#### 7.2.1.1 Maximum output power for category M1 and NB1/NB2

**Table 2.5-1: UE Power Class for category M1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **EUTRA band** | **Class 2**  **(dBm)** | **Tolerance**  **(dB)** | **Class 3 (dBm)** | **Tolerance (dB)** | **Class 5 (dBm)** | **Tolerance (dB)** |
| 253 |  |  | 23 | +/-2 | 20 | +/-2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance. | | | | | | |

**Table 2.5-2: UE Power Class for category NB1 and NB2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EUTRA band** | **Class 3 (dBm)** | **Tolerance (dB)** | **Class 5 (dBm)** | **Tolerance (dB)** |
| [253] | 23 | +/-2 | 20 | +/-2 |

#### 7.2.1.2 Emission requirements and NS values

##### 7.2.1.2.1 Spurious emission for category M1

Table 6.5A.4.3-1: Requirements for spurious emissions for UE co-existence

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| E-UTRA Band | Spurious emission | | | | | | |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| 253 | E-UTRA Band 5, 26, 41, 48  NR Band n1, n3, n7, n8, n18, n20, n28, n34, n38, n39, n40, n50, n51, n65, n67, n74, n75, n76, n79, n91, n92, n93, n94 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NR Band n77, n78 | FDL\_low | - | FDL\_high | -50 | 1 | 2 |
| NOTE 1: FDL\_low and FDL\_high refer to each E-UTRA frequency band specified in Table 5.4A.2-1  NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5A.4.2-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2, 3, 4, [5] for the 2nd, 3rd, 4th [or 5th] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.  NOTE 3: The co-existence between 256 and band 2, 25 and 70 is subject to regional/national regulation. | | | | | | | |

##### 7.2.1.3 Configured TX power

It is agreed the current TS 36.102 requirements can be re-used for band n253.

##### 7.2.1.4 Power control

It is agreed the current TS 36.102 requirements can be re-used for band n253.

##### 7.2.1.5 Frequency error

It is agreed the current TS 36.102 requirements can be re-used for band n253.

##### 7.2.1.6 Transmit modulation quality

It is agreed the current TS 36.102 requirements can be re-used for band n253.

### 7.2.2 UE receiver characteristics

#### 7.2.2.1 Reference sensitivity for category M1 and NB1/NB2

Table 7.3A-1: Reference sensitivity for FDD UE category M1 QPSK PREFSENS

|  |  |  |
| --- | --- | --- |
| NTN Band | REFSENS (dBm) | Duplex Mode |
| 253 | -102.7 | FDD |
| NOTE 1: The transmitter shall be set to PUMAX as defined in subclause 6.2.5- in TS 36.101 [7]. | | |

Table 7.3A-2: Reference sensitivity for HD-FDD UE category M1 QPSK PREFSENS

|  |  |  |
| --- | --- | --- |
| NTN Band | REFSENS (dBm) | Duplex Mode |
| 253 | -103.5 | HD-FDD |
| NOTE 1: The transmitter shall be set to PUMAX as defined in subclause 6.2.5 in TS 36.101 [7]. | | |

Table 7.3A-3: FDD UE category M1 Uplink configuration for reference sensitivity

|  |  |  |
| --- | --- | --- |
| E-UTRA Band | NRB | Duplex Mode |
| 253 | 61 | FDD and HD-FDD |
| 255 | 61 | FDD and HD-FDD |
| 256 | 61 | FDD and HD-FDD |
| NOTE 1: 1 refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.3A-1). | | |

#### 7.2.2.2 Blocking requirements

##### 7.2.2.2.1 In Band blocking requirements for category M1

Table 7.6A.2-1: In band blocking parameters

|  |  |  |
| --- | --- | --- |
| Rx parameter | Units | Channel bandwidth |
| 1.4 MHz |
| Power in Transmission Bandwidth Configuration | dBm | REFSENS + channel bandwidth specific value below |
| 6 |
| BWInterferer | MHz | 1.4 |
| FIoffset, case 1 | MHz | 2.1+0.0125 |
| FIoffset, case 2 | MHz | 3.5+0.0075 |
| NOTE 1: The transmitter shall be set to 4dB below PCMAX\_L at the minimum uplink configuration specified in Table 7.3A-3 with PCMAX\_L as defined in subclause 6.2.5 of TS 36.101 [7].  NOTE 2: The interferer consists of the Reference measurement channel specified in TS 36.101 [7] Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and set-up according to Annex C.3.1.  NOTE 3: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3A-1 should be used as REFSENS for the power in Transmission Bandwidth Configuration.  NOTE 4: For DL category M1 UE, the parameters for the applicable channel bandwidth apply. | | |

Table 7.6A.2-2: In-band blocking

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| E-UTRA band | Parameter | Unit | Case 1 | Case 2 |
| PInterferer | dBm | -56 | -44 |
| FInterferer (offset) | MHz | =-BW/2 – FIoffset,case 1  &  =+BW/2 + FIoffset,case 1 | ≤-BW/2 – FIoffset,case 2  &  ≥+BW/2 + FIoffset,case 2 |
| 256, 255, 253 | FInterferer | MHz | (NOTE 2) | FDL\_low – 15  to  FDL\_high + 15 |
| NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band  NOTE 2: For each carrier frequency the requirement is valid for two frequencies:  a. the carrier frequency -BW/2 - FIoffset, case 1 and  b. the carrier frequency +BW/2 + FIoffset, case 1  NOTE 3: FInterferer range values for unwanted modulated interfering signal are interferer center frequencies | | | | |

##### 7.2.2.2.2 Out-of-band blocking requirements for category M1

Table 7.6A.3-1: Out-of-band blocking parameters for category M1 UE

|  |  |  |
| --- | --- | --- |
| RX parameter | Units | Channel bandwidth (MHz) |
|  |  | 1.4 |
| Power in transmission bandwidth configuration | dBm | REFSENS + 6 dB |
| NOTE 1: The transmitter shall be set to 4dB below PCMAX\_L at the minimum uplink configuration specified in Table 7.3.1-2 in TS 36.101 [7] with PCMAX\_L as defined in subclause 6.2.5. | | |

Table 7.6A.3-2: Out of-band blocking for category M1 UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| 253, 255 | Finterferer (C`W) | MHz | -60 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| 2561 | Finterferer (CW) | MHz | -100 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -145 < f – FDL\_low ≤ -100  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 145  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 1: Band 256 lower frequency ranges are modified to enable specific implementations. | | | | | |

##### 7.2.2.2.3 Narrow band blocking for category M1

Table 7.6A.4-1: Narrow-band blocking

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Channel Bandwidth |
| 1.4 MHz |
| Pw | dBm | PREFSENS + channel-bandwidth specific value below |
| 22 |
| Puw (CW) | dBm | -55 |
| Fuw (offset for  *f* = 15 kHz) | MHz | 0.9075 |
| Fuw (offset for**  *f* = 7.5 kHz) | MHz |  |
| NOTE 1: The transmitter shall be set a 4 dB below PCMAX\_L at the minimum uplink configuration specified in Table 7.3A-3 with PCMAX\_L as defined in subclause 6.2.5 of TS 36.101 [7].  NOTE 2: Reference measurement channel is specified in TS 36.101 [7] Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 of TS 36.101 [7].  NOTE 3: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3A-1 should be used as PREFSENS for Pw.  NOTE 4: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.  NOTE 5: For DL category M1 UE, the parameter, Pw, for all the channel bandwidth will be PREFSENS +22 dBm. | | |

##### 7.2.2.2.4 Out-of-band blocking requirements for category NB1 and NB2

Table 7.6B.3-1: Out-of-band blocking parameters for category NB1 and NB2 UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
| Pw | dBm | REFSENS + 6 dB | | |
| Pinterferer | dBm | -44 | -30 | -153 |
| 253, 255 | Finterferer (CW) | MHz | -60 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -85 < f – FDL\_low ≤ -60  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 85  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| 2562 | Finterferer (CW) | MHz | -100 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -145 < f – FDL\_low ≤ -100  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 145  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 1: Void.  NOTE 2: Band 256 lower frequency ranges are modified to enable specific implementations.  NOTE 3: For operating bands which downlink band frequency range is between 1475.9 MHz < f < 2690 MHz the power level of the interferer (PInterferer) for Range 3 shall be modified to: -20 dBm for the frequency range which is bounded by FDL\_low- 200 MHz of the lowest band that UE supports in frequency range 1475.9 MHz < f < 2690 MHz and FDL\_high + 200 MHz of the highest band that UE supports in frequency range 1475.9 MHz < f < 2690 MHz.”  NOTE 4: The power level of the interferer (PInterferer) for Range 3 shall be modified to -20 dBm for FInterferer > 2800 MHz and FInterferer < 4400 MHz. | | | | | |

NOTE: As per the agreement raised in RAN4#109 below, the introduction of additional blocking requirements from ETSI EN 301 681 and recommendations from ECC Report 263 has been put on hold. Any ETSI- or ECC-specific requirements will be addressed after further feedback from ETSI is received.

**Issue 1-2-1: In-Band Blocking Requirements for Cat M1 + Issue 1-2-2: In-Band Blocking Requirements for Cat NB1 NB2**

Agreement:

* Put the action on capturing the additional blocking requirements from EN 301 681 and ECC Report 263 on hold until further information from ETSI, considering the UE implementation difficulty and the ongoing discussion in ETSI.
  + Send LS to *ETSI to show the discrepancy and applicability to device types*
  + Add the note in the TS and TR that the requirements would be defined after the feedback of ETSI is received.

**Issue 1-2-2: Out-of-Band Blocking Requirements for Cat M1 + Issue 1-2-2: In-Band Blocking Requirements for Cat NB1 NB2**

Agreement:

* Do not define the additional out-of-band blocking requirements in Rel-18
  + Further discuss it, if needed, in the future release in TEI or WI

### << End change >>