**3GPP TSG-RAN WG4 Meeting #113 R4-2420353**

**Orlando, USA, November 18th – 22nd, 2024**

**Title:** WF on requirements for NR IoT NTN bands

**Agenda Item:** 6.17, 6.18, 6.19

**Source: Moderator (Inmarsat)**

**Document for:** Approval

# Topic #1: NR-NTN S-band

### Sub-topic 1-1: General Requirements and Coexistence Aspects

#### Issue 1-1-1: Regional Applicability

**Agreement:**

* + No note is needed in clause 5.2 operating band of TS 38.108 and TS 38.101-5 to clarify regional applicability of band n252.

#### Issue 1-1-2: TN-NTN Isolation Distance

* **Tentative Agreement:**
  + The TN-NTN coexistence assumption of 1.5 km separation between NTN UE and edge of the TN coverage from TR 38.863 does not represent a realistic deployment scenario
    - Revision of the general TN-NTN coexistence assumptions is not in scope of this WI

Ericsson: comments were not captured.

T-Mobile USA: we should be clear that this is for DL and isolation of n66/B66. Is that common understanding?

Moderator: TR captures the general assumption.

T-Mobile: this is the separate scenario from TR.

Verizon: if there is other UE in TN adjacent, it will be impacted.

* **Tentative Agreement:**
  + The TN-NTN coexistence assumption of 1.5 km separation between NTN UE and edge of the TN coverage from TR 38.863 has been used to guarantee the minimal performance on both TN and NTN networks. Nevertheless, this does not represent the usual deployment since NTN UE may still operate in the isolation distance
    - Revision of the general TN-NTN coexistence assumptions is not in scope of this WI

#### Issue 1-1-3: UE to UE Coexistence between n252 UL and n2/b2/n25/b25 DL

* **Tentative Agreement**
  + Agree to a [TBD]dBm/MHz additional spurious emission requirement, and corresponding A-MPR, for protection of band b25/n25/b2/n2 in addition to specifying asymmetric channel bandwidths with 5, 10 and [15] MHz UL CHBW for band n252.
    - For TBD, consider two values with two different NS
      * -30dBm/MHz for relaxed value
      * FFS for the other value

**T-Mobile: we suggest two different requirements. -40 and other value is TBD**

#### Issue 1-1-4: Protection of n70 and n66

* Proposals
  + Option 1: (Huawei, HiSilicon) For new S-band n252, the following spurious emission requirements for UE-to-UE coexistence can be specified for addressing the UE-to-UE coexistence with band n70, n66.

| NR NTN satellite Band | Spurious emission for UE co-existence | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| n252 | NR Band n70 | FDL\_low | - | FDL\_high | NA | NA | X |
| NR Band n66 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NOTE X: The co-existence between New NTN S-band and band n70 is subject to regional/national regulation. | | | | | | | |

* + Option 2: Other
* Recommended WF
  + Based on previous agreements, consider if the content of Option 1 can be captured in the TR.

Boost Mobile: Clarify -50dBm requirement for outside band n252?

China Telecom: Huawei just provided an example. And specific band numbers can be added.

Verizon: It should not include n25.

Moderator: it is just for n70/n66.

Agreement:

* + For new S-band n252, the following spurious emission requirements for UE-to-UE coexistence can be specified for addressing the UE-to-UE coexistence with band n70, n66.

| NR NTN satellite Band | Spurious emission for UE co-existence | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| n252 | NR Band n70 | FDL\_low | - | FDL\_high | NA | NA | X |
| NR Band n66 | FDL\_low | - | FDL\_high | -50 | 1 |  |
| NOTE X: The co-existence between n252 and band 70 is subject to regional/national regulation. | | | | | | | |

*MODERATOR NOTE: RAN4#112 Agreement is as follows:*

***Agreement:***

* + *Focus on coexistence of S-band UL with B2/n2 and B25/n25 DL.*
  + ***Capture the clarifications on the co-existence issues with*** *B70/n70 and B66/n66* ***and that there is no 3GPP solution for them*** *in the TR*

#### Issue 1-1-5: Protection of 1559 ~ 1610 MHz

* Proposals
  + Option 1: (Huawei, HiSilicon) For new S-band n252, the following spurious emission requirements for UE-to-UE coexistence can be specified for addressing the UE-to-UE coexistence with.

| NR NTN satellite Band | Spurious emission for UE co-existence | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Protected band | Frequency range (MHz) | | | Maximum Level (dBm) | MBW (MHz) | NOTE |
| New NTN S-band | Frequency range | 1559 | - | 1610 | -50 | 0.7 |  |
|  | | | | | | | |
|  | | | | | | | |

* + Option 2: Other
* Recommended WF
  + Consider if Option 1 can be agreed.

**Qualcomm: need check if it is aligned with regulation.**

**Skyworks: need to check and there are more system.**

**Huawei: this is copied from FCC.**

**Echostar: We can come back in the next meeting.**

### Sub-topic 1-2: UE RF

*Sub-topic description: General UE RF Requirements*

#### Issue 1-2-1: SS Raster

* Proposals
  + Option 1 (CATT): For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster entries with SSB pattern Case B or Case C could be introduced only if the operator has an explicit request.
  + Option 2: Other
* Recommended WF
  + Consider if Option 1 can be agreed.

**Echostar: we have scenario with need of both Case C and Case B.**

**Nokia: OK with this.**

**CATT: Case B is for LTE-NR co-channel co-existence like DSS. We may not need to introduce any configuration.**

**Moderator: Case B is in part of draft CR in previous meeting and said that come back for this meeting.**

**Qualcomm: 15Khz SCS only uses Case A.**

**Tentative agreement:**

* For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster entries with SSB pattern Case B and Case C could be introduced.

#### Issue 1-2-2: UE TX-RX Separation

* Proposals
  + Option 1: (ZTE Corporation, Sanechips) draftCR to TS38.101-5 Introduction of NR-NTN S band
  + Option 2: other
* Recommended WF
  + Agree proposal from the CR in Option 1
    - MODERATOR NOTE: Flexible TX-RX separation has already been agreed for this band.

Qualcomm: We are OK to introduce flexible Tx-Rx separation. Revise CR.

Echostar: We need capture that we have done n256 and n254 in the same manner.

CATT: For CR we do not need the revise it.

Qualcomm

Agreement:

* Specify the flexible Tx-Rx separation for n252 with the wording aligned with n255 and n256 in 38.101-5.

#### Issue 1-2-3: Two antenna port PREFSENS

* Proposals
  + Option 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the REFSENS should be defined as Table 2.2-1. (CATT)

Table 2.2-1: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands

| Operating band / SCS / Channel bandwidth | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5  MHz (dBm) | 10  MHz (dBm) | 15  MHz (dBm) | 20  MHz (dBm) | 25  MHz (dBm) | 30 MHz (dBm) | 35 MHz (dBm) | 40  MHz (dBm) | 45 MHz (dBm) | 50  MHz (dBm) |
|  | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  |  |  |  |  |
| n256 | 30 |  | -96.6 | -94.6 | -93.5 |  |  |  |  |  |  |
|  | 60 |  | -97.0 | -94.9 | -93.7 |  |  |  |  |  |  |
|  | 15 | -100.0 | -96.8 | -95.0 | -93.8 |  |  |  |  |  |  |
| n255 | 30 |  | -97.1 | -95.1 | -94.0 |  |  |  |  |  |  |
|  | 60 |  | -97.5 | -95.4 | -94.2 |  |  |  |  |  |  |
|  | 15 | -99.5 | -96.3 | -94.5 |  |  |  |  |  |  |  |
| n254 | 30 |  | -96.6 | -94.6 |  |  |  |  |  |  |  |
|  | 60 |  | -97.0 | -94.9 |  |  |  |  |  |  |  |
| n252 | 15 | -100 | -96.8 | -95.0 | -93.8 |  |  |  |  |  |  |
| 30 |  | -97.1 | -95.1 | -94.0 |  |  |  |  |  |  |
| 60 |  | -97.5 | -95.4 | -94.2 |  |  |  |  |  |  |
| NOTE：The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | | |

* + Option 2: draftCR to TS38.101-5 Introduction of NR-NTN S band (ZTE Corporation, Sanechips)

Table 7.3.2-1: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands

| Operating band / SCS / Channel bandwidth | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5  MHz (dBm) | 10  MHz (dBm) | 15  MHz (dBm) | 20  MHz (dBm) | 25  MHz (dBm) | 30 MHz (dBm) | 35 MHz (dBm) | 40  MHz (dBm) | 45 MHz (dBm) | 50  MHz (dBm) |
|  | 15 | -99.5 | -96.3 | -94.5 | -93.3 |  |  |  |  |  |  |
| n256 | 30 |  | -96.6 | -94.6 | -93.5 |  |  |  |  |  |  |
|  | 60 |  | -97.0 | -94.9 | -93.7 |  |  |  |  |  |  |
|  | 15 | -100.0 | -96.8 | -95.0 | -93.8 |  |  |  |  |  |  |
| n255 | 30 |  | -97.1 | -95.1 | -94.0 |  |  |  |  |  |  |
|  | 60 |  | -97.5 | -95.4 | -94.2 |  |  |  |  |  |  |
|  | 15 | -99.5 | -96.3 | -94.5 |  |  |  |  |  |  |  |
| n254 | 30 |  | -96.6 | -94.6 |  |  |  |  |  |  |  |
|  | 60 |  | -97.0 | -94.9 |  |  |  |  |  |  |  |
|  | 15 | -100 | -96.8 | -95.0 | -93.8 |  |  |  |  |  |  |
| n252 | 30 |  | -97.1 | -95.1 | -94.0 |  |  |  |  |  |  |
|  | 60 |  | -97.5 | -95.4 | -94.2 |  |  |  |  |  |  |
| NOTE：The transmitter shall be set to PUMAX as defined in clause 6.2.4 of 3GPP TS 38.101-1 [5]. | | | | | | | | | | | |

* + Option 3: Consider using table below as band n252 REFSENS.

| Operating band / SCS / Channel bandwidth | | | | | |
| --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5  MHz (dBm) | 10  MHz (dBm) | 15  MHz (dBm) | 20  MHz (dBm) |
|  | 15 | -99.5 | -96.3 | -94.5 | -93.3 |
| n252 | 30 |  | -96.6 | -94.6 | -93.5 |
|  | 60 |  | -97.0 | -94.9 | -93.7 |

* + Option 4: Other
* Recommended WF
  + TBA

ZTE: our motivation is that the reference sensitivity from the coincided band can be reused here.

Echostar: Option 1.

Qualcomm: need consider other NTN band and Option 3. This band is overlapping with n256.

Apple: Option 3 is more reasonable.

CATT: refer to Option 1.

Mediatek: Option 3. The design considers n252 and n256.

Sony: We just reuse the existing values for n256. Agree with Qualcomm and Apple.

Echostar: This is for North America. You cannot have the same implementation for n252 as that for n256.

#### Issue 1-2-4: UL Configuration for REFSENS

* Proposals
  + Option 1: (ZTE Corporation, Sanechips)

Table 7.3.2-2: Uplink configuration for reference sensitivity

| Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Operating Band | SCS | 5 | 10 | 15 | 20 | Duplex Mode |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n256 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
|  | 15 | 25 | 50 | 75 | 752  503 |  |
| n255 | 30 |  | 24 | 36 | 362  243 | FDD |
|  | 60 |  | 10 | 18 | 182  103 |  |
|  | 15 | 25 | 50 | 75 |  |  |
| n254 | 30 |  | 24 | 36 |  | FDD |
|  | 60 |  | 10 | 18 |  |  |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n252 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
| NOTE: 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 in Table 5.3.2-1. | | | | | | |

* + Option 2: Other
* Recommended WF
  + TBA

Agreement:

* For UL Configuration for REFSENS, agree on the following table.
* Table 7.3.2-2: Uplink configuration for reference sensitivity

| Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| Operating Band | SCS | 5 | 10 | 15 | 20 | Duplex Mode |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n256 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
|  | 15 | 25 | 50 | 75 | 752  503 |  |
| n255 | 30 |  | 24 | 36 | 362  243 | FDD |
|  | 60 |  | 10 | 18 | 182  103 |  |
|  | 15 | 25 | 50 | 75 |  |  |
| n254 | 30 |  | 24 | 36 |  | FDD |
|  | 60 |  | 10 | 18 |  |  |
|  | 15 | 25 | 50 | 75 | 100 |  |
| n252 | 30 |  | 24 | 36 | 50 | FDD |
|  | 60 |  | 10 | 18 | 24 |  |
| NOTE: 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 in Table 5.3.2-1. | | | | | | |

#### Issue 1-2-5: Out-of-band Blocking

* Proposals
  + Option 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the OOBB should be defined as Table 2.3-1 (CATT)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| n252 | 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 |
| n2542 | 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 |
| n255 | 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 |
| n2561 | 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 n256 lower frequency ranges are modified to enable specific implementations  NOTE 2: Band n254 power level of the interferer (Pinterferer) for Range 3 shall be modified to -20 dBm for Finterferer > 2585 MHz and FInterferer < 2775 MHz.  NOTE 3: void  NOTE 4: void | | | | | |

* + Option 2: draftCR to TS38.101-5 Introduction of NR-NTN S band (ZTE Corporation, Sanechips)

Table 7.6.3-2: Out of-band blocking for NR satellite bands with FDL\_high < 2700 MHz and FUL\_high < 2700 MHz

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| n252 | Finterferer (CW) | MHz | -70 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -95 < f – FDL\_low ≤ -70  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 95  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| n2542 | 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 |
| n255 | 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 |
| n2561 | 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 n256 lower frequency ranges are modified to enable specific implementations  NOTE 2: Band n254 power level of the interferer (Pinterferer) for Range 3 shall be modified to -20 dBm for Finterferer > 2585 MHz and FInterferer < 2775 MHz.  NOTE 3: void  NOTE 4: void | | | | | |

* + Option 3: Consider using table below as a starting point for band n252 out-of-band blocking requirements. (Mediatek India Technology Pvt.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| n2523 | Finterferer (CW) | MHz | -70 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -95 < f – FDL\_low ≤ -70  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 95  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 3: Band n252 lower frequency ranges are modified to enable specific implementations. | | | | | |

* + Option 4: Other
* Recommended WF
  + TBA

Mediatek: We cannot directly reuse the values from other NTN bands.

Qualcomm: need further discussions. In our view, n252 may go back to n256. It is like a slightly extension of frequency range.

### Sub-topic 1-3: SAN RF

*Sub-topic description: SAN RF requirements for band n252*

#### Issue 1-3-1: SAN SS Raster

* Proposals
  + Option 1: Option 1 (CATT): For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster entries with SSB pattern Case B or Case C could be introduced only if the operator has an explicit request.
  + Option 2: Other
* Recommended WF
  + Consider if Option 1 can be agreed.

### Sub-topic 1-4: RRM Requirements

*Sub-topic description: RRM requirements for band n252*

*No open issues and candidate options before meeting – focus on discussing if CRs can be endorsed and CR work split.*

# Topic #2 IoT-NTN S-band

### Sub-topic 2-1: UE RF

*Sub-topic description: UE RF requirements*

#### Issue 2-1-1: UE TX-RX Separation

* Proposals
  + Option 1: Based on R4-2418355 (ZTE Corporation, Sanechips)
  + Option 2: To support the variable Tx-Rx frequency separation is feasible for all IoT-NTN bands (e.g., 256, 255, 254, 253, and 252). (Mediatek India Technology Pvt)
  + Option 3: other
* Way Forward:
  + Based on previous agreements, consider if Option 2 can be agreed. Handle necessary CRs for other IoT NTN bands in the maintenance phase.

Qualcomm: we should not make agreements in this WI to maintain IoT NTN band.

Agreement:

* Specify the variable Tx-Rx frequency separation for Band B252
* Discuss the applicability of variable Tx-Rx frequency separation for other IoT NTN bands under other agendas.

*MODERATOR NOTE: The following agreement was reached in RAN4#112bis*

* ***Agreement***
  + *Consider 180MHz default Tx-Rx separation as starting point.* 
    - *Support of flexible Tx-Rx separation is not precluded based*
    - *Applicability for other bands should also be considered*

#### Issue 2-1-2: UE Maximum Output Power for Cat M1 and NB1/NB2

* Proposals
  + Option 1: Based on R4-2418355 (ZTE Corporation, Sanechips)

Table 6.2A.1-1: UE Power Class

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EUTRA band | Class 2  (dBm) | Tolerance  (dB) | Class 3 (dBm) | Tolerance (dB) | Class 5 (dBm) | Tolerance (dB) |
| 256 |  |  | 23 | +/-2 | 20 | +/-2 |
| 255 |  |  | 23 | +/-2 | 20 | +/-2 |
| 254 |  |  | 23 | +/-2 | 20 | +/-2 |
| 253 |  |  | 23 | +/-2 | 20 | +/-2 |
| 252 |  |  | 23 | +/-2 | 20 | +/-2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance. | | | | | | |

Table 6.2B.1-1: UE Power Class

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) | Class 5 (dBm) | Tolerance (dB) |
| 256 | 23 | +/-2 | 20 | +/-2 |
| 255 | 23 | +/-2 | 20 | +/-2 |
| 254 | 23 | +/-2 | 20 | +/-2 |
| 253 | 23 | +/-2 | 20 | +/-2 |
| 252 | 23 | +/-2 | 20 | +/-2 |

* Option 2: Regarding solution for PC3 HD-FDD TX output power upper bound higher than 25dBm, consider a specific or general solution for all IoT-NTN bands. The solution is applicable for solving the same issue in PC5 and PC2. The options are as follows. (Mediatek India Technology Pvt)
* ***Option 2-1: Add additional note to increase the upper tolerance for NTN HD-FDD operation in applicable regions.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EUTRA band | Class 2  (dBm) | Tolerance  (dB) | **Class 3 (dBm)** | **Tolerance (dB)** | Class 5 (dBm) | Tolerance (dB) |
| 256 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 255 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 254 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 253 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 252 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance.  **NOTE 2: When UEs recognizes and supports NTN HD-FDD operation in XXX region, the upper tolerance requirement can be increased from +2dB to [+2.7dB or +TT-NTN-HDFDD].** | | | | | | |

* ***Option 2-2: Add additional UE capability and NW signal to control NTN HD-FDD power increment.*** 
  + ***Option 2-2-1:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EUTRA band | Class 2  (dBm) | Tolerance  (dB) | **Class 3 (dBm)** | **Tolerance (dB)** | Class 5 (dBm) | Tolerance (dB) |
| 256 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 255 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 254 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 253 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| 252 | 26 | +22 | **23** | **+22, -2** | 20 | +22, -2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance.  **NOTE 2: When IoT-NTN UE operates in HD-FDD and indicates support for UE optional capability x1-r19 and if IE x2-r19 is set to 1. The MOP upper tolerance is further increased by ΔPNTNHdFdd from 2dB.** | | | | | | |

* + ***Option 2-2-1:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EUTRA band | Class 2  (dBm) | Tolerance  (dB) | **Class 3 (dBm)** | **Tolerance (dB)** | Class 5 (dBm) | Tolerance (dB) |
| 256 | 262 | +2 | **232** | **+2, -2** | 202 | +2, -2 |
| 255 | 262 | +2 | **232** | **+2, -2** | 202 | +2, -2 |
| 254 | 262 | +2 | **232** | **+2, -2** | 202 | +2, -2 |
| 253 | 262 | +2 | **232** | **+2, -2** | 202 | +2, -2 |
| 252 | 262 | +2 | **232** | **+2, -2** | 202 | +2, -2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance.  **NOTE 2: When IoT-NTN UE operates in HD-FDD and indicates support for UE optional capability x1-r19 and if IE x2-r19 is set to 1. The reference power is increased by ΔPNTNHdFdd.** | | | | | | |

* + ***Option 2-3: Add new power classes (e.g., PC4.5\_NTN-HD-FDD, PC2.5\_NTN-HD-FDD, PC1.75\_NTN-HD-FDD).***
  + Option 3: other
* Proposed WF:
  + TBA

Mediatek: We can defer the decision.

Qualcomm: it is the same discussion in the same NTN HPUE and RedCap NTN UE session.

Agreement:

* + The MOP of this band will be aligned with the agreements in other Rel-19 NTN related WIs.

#### Issue 2-1-10: Out-of-band blocking for Cat-M1

* Proposals
  + Option 1: Based on R4-2418355 (ZTE Corporation, Sanechips)
* 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 |
| 252 | Finterferer (CW) | MHz | -70 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -95 < f – FDL\_low ≤ -70  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 95  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| 253, 2542, 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.  NOTE 2: The power level of the interferer (Pinterferer) for Range 3 shall be modified to -20 dBm for Finterferer > 2585 MHz and FInterferer < 2775 MHz. | | | | | |

* + Option 2: Consider using tables below as a starting point for band B252 out-of-band blocking requirements. (Mediatek India Technology Pvt)
    - Observation: It is expected that the same duplexer filter would be used for both B256 and B252.

Table X: Out of-band blocking parameters for category M1 UE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating Band | Parameter | Unit | Range 1 | Range 2 | Range 3 |
|  | Pinterferer | dBm | -44 | -30 | -15 |
| 2523 | Finterferer (CW) | MHz | -70 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -95 < f – FDL\_low ≤ -70  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 95  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| NOTE 3: Band 252 lower frequency ranges are modified to enable specific implementations. | | | | | |

* + Option 3: Other
* Recommended WF
  + TBA

Qualcomm: The frequency ranges should be aligned between NR band and IoT NTN band. First agree on NR and reuse the agreement of NR to IoT-NTN band.

Mediatek: To Qualcomm, we may agree on IoT-NTN first.

#### Issue 2-1-11: Out-of-band blocking for Cat-NB1/NB2

* Proposals
  + Option 1: Based on R4-2418355 (ZTE Corporation, Sanechips)
* 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 |
| 252 | Finterferer (CW) | MHz | -70 < f – FDL\_low < -15  or  15 < f – FDL\_high < 60 | -95 < f – FDL\_low ≤ -70  or  60 ≤ f – FDL\_high < 85 | 1 ≤ f ≤ FDL\_low – 95  or  FDL\_high + 85 ≤ f  ≤ 12750 |
| 253, 2545, 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 5: The power level of the interferer (Pinterferer) for Range 3 shall be modified to -20 dBm for Finterferer > 2585 MHz and FInterferer < 2775 MHz. | | | | | |

* + Option 2: Other
* Recommended WF
  + TBA

### Sub-topic 2-2: SAN RF

*Sub-topic description: SAN RF Requirements*

*No open issues and candidate options before meeting – focus on discussing if CRs can be endorsed and CR work split*

### Sub-topic 2-3: RRM Requirements

*Sub-topic description: RRM requirements*

*No open issues and candidate options before meeting – focus on discussing if CRs can be endorsed and CR work split.*

# Topic #3: NR-NTN L-bands

### Sub-topic 3-1: General Aspects and Regulatory Input

*Sub-topic description: Regulatory aspects*

#### Issue 3-1-1: General Approach for Capturing Additional Regulatory Radiated Emission Requirements (e.g. ITU, ETSI, FCC)

* Proposals
  + Option 1 (Inmarsat, Viasat):
    - Proposal 1: 3GPP should identify the appropriate methodology to capture radiated regulatory requirements in the specification(s), in such a way that ensures compliance to regulations in all operational scenarios, but does not create unnecessary implementation burden.
    - Proposal 2: 3GPP is already in the process of defining FR1 OTA radiated requirements for UE. A possible approach could be the introduction of these requirements under new sections on OTA radiated requirements in the corresponding UE RF specs.
    - Proposal 3: Whether there is a need for conversion of regulatory emission limits from radiated to conducted requirements should also be further discussed
  + Option 2: Other
* Recommended WF
  + Agree Option 1, Proposal 1 as a starting point.
  + Consider if Option 1, Proposal 2 can be agreed.
  + Agree Option 1, Proposal 3.

Huawei: is it proposing to specify FR1 OTA core requirement?

Qualcomm: There is long standing principle to translate to the radiated regulation. This is important topic. We do not have any FR1 OTA requirement for NTN domain.

Inmarsat: We need capture them in the 3GPP spec to make regulation solid.

Huawei: 45dBm EIRP is very high. It is very hard to meet this regulation requirement by using 23dBm UE.

Mediatek: Share the similar view as Inmarsat. EIRP is the final requirement. There will be antenna gain.

#### Issue 3-1-2: Optionality for assessment of additional Regulatory Radiated Emission Requirements as Conducted requirements

* Proposals
  + Option 1 (Inmarsat, Viasat):
    - Proposal 1: The option to assess compliance to ETSI EN 301 681 radiated requirements by conducted means should be captured in a note within the specification, stating that antenna characteristics over the full frequency range are required in order to suitable assess the compliance to these radiated requirements.
    - Proposal 2: This approach to assess compliance to ETSI EN 301 681 should also be considered for FCC part 25.202. With the radiated requirements being ascertained by conducted means and the radiated requirements can be discerned for regulatory approval using an appropriate characterisation of the UE antenna over the required frequency response. This process should also be captures in a note within the specification.
  + Option 2: Other
* Recommended WF
  + Consider if Option 1 Proposal 1 and Option 1 Proposal 2 can be agreed.

Echostar: We need look at the other aspects and actual antenna gain. This is useful discussion for 3GPP.

Qualcomm: this is like further study. How to do it? We need the assumption of what the antenna gain is.

#### Issue 3-1-3: ETSI additional blocking Requirements

* Proposals
  + Option 1: Proposal 1: For two new NR NTN L bands, referring to the conclusions in Rel-18 for band 253, do not define the additional in-band / out-of-band blocking requirements in Rel-19 until RAN4 gets clear information from ETSI. (Huawei, HiSilicon)
  + Option 2: Other
* Recommended WF
  + Agree Option 1 as a starting point, the issue can be further revisited in the maintenance phase, or in case further guidance from ETSI is available.

Agreement:

* + For two new NR NTN L bands, referring to the conclusions in Rel-18 for band 253, do not define the additional in-band / out-of-band blocking requirements in Rel-19 until RAN4 gets clear information from ETSI.

#### Issue 3-1-4: Protection of Radio Astronomy stations – Duplexer dependency

* Proposals
  + Option 1: The requirements to protect Radio Astronomy service operation are independent with the duplexer implementation. (Huawei, HiSilicon)
  + Option 2: Other
* Recommended WF
  + Agree Option 1

Agreement:

* + The requirements to protect Radio Astronomy service operation are independent with the duplexer implementation.

#### Issue 3-1-5: Requirements and Mechanisms on Protection of Radio Astronomy stations

* Proposals
  + Option 1: At least, it seems feasible to have one duplexer covering bands n253 and n250. Two options are as follows. Regarding these two options, further NW signal can be considered to control UL RB allocations or A-MPR to protect Radio Astronomy if necessary. (Mediatek India Technology Pvt)
    - Option 1-1: One duplexer covers bands n253 and n250. One duplexer covers band n251. Consider UL RB allocations or A-MPR to protect Radio Astronomy in the 1660-1668MHz range.
    - Option 1-2: One duplexer covers bands n253, n250 and n251. Compared to Option 1, consider UL RB allocations or more A-MPR to protect Radio Astronomy in the 1660-1668MHz range.
  + Option 2:
    - Option 2-1: Specify a “TX disable” signal to be issued by the Network when a UE is close to a radioastronomy station which is registered in the ITU master international frequency register.
    - Option 2-2: Further study mechanisms to improve protection of Radio Astronomy stations, the following options could be considered:
      * TX Disable
      * RB restrictions
      * NS
* Recommended WF
  + TBA

Qualcomm: One issue is how to handle the requirement for n255. We should look at all the options to check the best approach.

Huawei: The requirement is to ask UE to have function to disable the Tx when there is some collision. Not sure how to handle it. There is no traditional way.

Inmarsat: We can further discuss Tx disable. Tx disable is some new requirement.

Qualcomm: For RB restriction, we need be clear how to specify: is it BS scheduling restriction or some UE burden where UE do not follow BS.

#### Issue 3-1-6: Signalling of proximity to Radio Astronomy stations

* Proposals
  + Option 1 (Inmarsat, Viasat):
    - Proposal 1: Further investigation is required in order to understand what ‘close’ to a radioastronomy station means in practical distances and limits depending on device transmission characteristics.
    - Proposal 2: Derivation of distance from a RA station which yields this PFD performance should be calculated, and these distances / limits may become an additional network signalled value in the event a UE is within this distance from an RA station on the ITU master frequency international register.
  + Option 2: Other
* Recommended WF

Consider if Option 1 Proposal 1 and Option 1 Proposal 2 can be agreed.

Qualcomm: one additional aspect: can Satellite beam avoid some area?

Inmarsat: In some case, in some other case it could not be possible. It depends on UL frequency used.

### Sub-topic 3-2: UE RF

*Sub-topic description: System parameters and UE RF aspects*

#### Issue 3-2-1: UE Duplexer

* Proposals
  + Option 1: When RAN4 discuss the RF requirements for the new introduced NR NTN L-bands, the implementation should be considered with only one duplexer (DL: 1518 – 1559 MHz, UL: 1626.5 – 1675 MHz) to cover all four L-bands, i.e. n255, n253, n251 and n250. (Huawei, HiSilicon)
  + Option 2: At least, it seems feasible to have one duplexer covering bands n253 and n250. Two options are as follows. Regarding these two options, further NW signal can be considered to control UL RB allocations or A-MPR to protect Radio Astronomy if necessary. (Mediatek India Technology Pvt)
    - Option 2-1: One duplexer covers bands n253 and n250. One duplexer covers band n251. Consider UL RB allocations or A-MPR to protect Radio Astronomy in the 1660-1668MHz range.
    - Option 2-2: One duplexer covers bands n253, n250 and n251. Compared to Option 1, consider UL RB allocations or more A-MPR to protect Radio Astronomy in the 1660-1668MHz range.
  + Option 2: Other
* Recommended WF
  + TBA

Moderator: it seems that we use the single duplexer for all the NTN bands, which would not be possible.

Qualcomm: If we agree the single duplexer, we need reflect it in blocking requirements in a consistent way for all the bands.

Apple: In principle, we do not know whether it is possible.

Huawei: we have discussed the protection. We concluded that duplexer is independent for protection. This requirement asks UE to disable Tx. We can decouple duplexer discussion from protection. For B255/n255, we are OK to review the impact.

Inmarsat: we do not tend to impact the requirements and cannot mandate the single duplexer.

Qualcomm: for impact on regular protection, UE is aware of it. Network should be aware. It should be network burden.

### Sub-topic 3-3: SAN RF

*Sub-topic description: SAN RF requirements*

*No open issues and candidate options before meeting – focus on discussing if CRs can be endorsed and CR work split*

### Sub-topic 3-4: RRM Requirements

*Sub-topic description: RRM aspects*

*No open issues and candidate options before meeting – focus on discussing if CRs can be endorsed and CR work split.*