**3GPP TSG-RAN WG4 Meeting #112 R4-2412816**

**Maastricht, NL 19th ‒ 23rd August, 2024**

**Agenda item:** 7.1

**Source:** Moderator (Inmarsat)

**Title:** Draft Topic summary for [112][114] NR\_IoT\_NTN\_Bands

**Document for:** Information

# Introduction

*This Topic Summary covers the introduction of new NTN bands for NR and IoT under the scope of three Work Items as follows:*

|  |  |  |
| --- | --- | --- |
| WI  | WI Title | AI |
| NR\_NTN\_Sband-CoreIoT\_NTN\_FDD\_S\_band-CoreNR\_NTN\_combinedLband-Core | 7.17 Introduction of NR-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL)7.18 Introduction of IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL)7.19 Introduction of new NR NTN bands to support the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz) | 7.177.187.19 |

# Topic #1: NR\_NTN\_Sband

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411058.zip) | CATT | This contribution provides our initial views on SAN requirements for introduction of the NTN new S-band. The following proposals are concluded as follows:**Proposal 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the new band should be numbered as Table 2.1-1.**Table 2.1-1: Satellite *operating bands* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite *operating band* | Uplink (UL) *operating band*SAN receive / UE transmitFUL,low – FUL,high | Downlink (DL) *operating band*SAN transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| [n252] | 2000 MHz - 2020 MHz  | 2180 MHz - 2200MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from n256. |

**Proposal 2: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel bandwidth and SCS should be defined as Table 2.2-1.**Table 2.2-1: *SAN channel bandwidths* and SCS per *operating band* in FR1

| SAN Operating Band | SCS (kHz) | *SAN channel bandwidth* (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 |
|  | 15 | 5 | 10 | 15 | 20 |
| [n252] | 30 |  | 10 | 15 | 20 |
|  | 60 |  | 10 | 15 | 20 |

**Proposal 3: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel raster should be defined as Table 2.3-1 and Table 2.3-2.**Table 2.3-1: Applicable NR-ARFCN per *operating band* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 100 | 400000 – <20> – 404000 | 436000 – <20> – 440000 |

Table 2.3-2: Applicable NR-ARFCN per *operating band* for enhanced channel raster

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 |

**Proposal 4: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster should be defined as Table 2.4-1.**Table 2.4-1: Applicable SS raster entries per *operating band* (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| n256 | 15 kHz | Case A | 5429 – <1> – 5494 |
| n255 | 15 kHz | Case A | 3818 – <1> – 3892 |
|  | 30 kHz | Case B | 3824 – <1> – 3886 |
| n254 | 15 kHz | Case A | 6215 – <1> – 6244 |
|  | 30kHz | Case C | 6218 – <1> – 6241 |
| [n252] | 15 kHz | Case A | 5456 – <1> – 5494 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [7]. |

**Proposal 5: For TS 38.108, no RF requirements impact by introducing the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz. The existing SAN type 1-H and 1-O RF requirements are applicable to new band.** |
| [**R4-2411059**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411059.zip) | CATT | This contribution provides our initial views on UE requirements for introduction of the NTN new S-band. The following proposals are concluded as follows:**Proposal 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the new band should be numbered as Table 2.1-1.**Table 2.1-1: NTN Satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n252] | 2000 MHz - 2020 MHz  | 2180 MHz - 2200MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from n256. |

**Proposal 2: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel bandwidth and SCS should be defined as Table 2.2-1.**Table 2.2-1: Channel bandwidths for each NTN satellite band in FR1-NTN

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 |
|  | 15 | 5 | 10 | 15 | 20 |
| [n252] | 30 |  | 10 | 15 | 20 |
|  | 60 |  | 10 | 15 | 20 |

**Proposal 3: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel raster should be defined as Table 2.3-1 and Table 2.3-2.**Table 2.3-1: Applicable NR-ARFCN per operating band in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) |
| [n252] | 100 | 400000 – <20> – 404000 | 436000 – <20> – 440000 |

Table 2.3-2: Applicable NR-ARFCN per operating band in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) |
| [n252] | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 |

**Proposal 4: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster should be defined as Table 2.4-1.**Table 2.4-1: Applicable SS raster entries per *operating band* (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| n256 | 15 kHz | Case A | 5429 – <1> – 5494 |
| n255 | 15 kHz | Case A | 3818 – <1> – 3892 |
|  | 30 kHz | Case B | 3824 – <1> – 3886 |
| n254 | 15 kHz | Case A | 6215 – <1> – 6244 |
|  | 30kHz | Case C | 6218 – <1> – 6241 |
| [n252] | 15 kHz | Case A | 5456 – <1> – 5494 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [7]. |

**Proposal 5: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the TX-RX frequency separation should be defined as Table 2.5-1.**Table 2.5-1: UE TX-RX frequency separation (FR1-NTN)

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [n252] | 180 MHz |

**Proposal 6: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the maximum output power should be defined as Table 2.6-1.**Table 2.6-1: UE Power Class

|  |  |  |
| --- | --- | --- |
| NR satellite band | Class 3 (dBm) | Tolerance (dB) |
| [n252] | 23 | ±2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the toleranceNOTE 2: Powerclass 3 is default power class unless otherwise stated |

**Proposal 7: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, RAN4 should clarify the intended regions and/or countries where the new NTN bands deployed.** |
| [**R4-2411060**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411060.zip)**(Draft CR)** | CATT | **Title:** DraftCR for TS 38.101-5, Introduction on system parameters for UE supporting new S Band**Type:** Draft CR (Cat. B)**Target Spec:** TS 38.101-5**Reason:** To introduce system parameters for UE supporting new S Band**Summary of change:** To introduce operating band for UE supporting new S BandTo introduce UE channel bandwidth for SAN supporting new S BandTo introduce channel raster for UE supporting new S BandTo introduce TX-RX frequency separation for UE supporting new S BandTo introduce UE maximum output power for UE supporting new S Band |
| [**R4-2411061**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411061.zip)**(Draft CR)** | CATT | **Title:** DraftCR for TS 38.108, Introduction on system parameters for SAN supporting new S Band**Type:** Draft CR (Cat. B)**Target Spec:** TS 38.108**Reason:** To introduce system parameters for SAN supporting new S Band**Summary of change:**To introduce operating band for SAN supporting new S BandTo introduce SAN channel bandwidth for SAN supporting new S BandTo introduce channel raster for SAN supporting new S Band |
| [**R4-2411195**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411195.zip) | Ericsson | This contribution is giving an overview of the impact on the existing SAN RF requirements as specified in TS 38.108.[MODERATOR NOTE: No proposals included in the contribution. Reporting here a distilled list of sections with impact identified].**System Parameters**

|  |  |
| --- | --- |
| Requirements | Expected impact |
| 4. General |  |
| 4.1 Relationship with other core specifications | No impact |
| 4.2 Relationship between minimum requirements and test requirements | No impact |
| 4.3 Requirement reference points | No impact |
| 4.4 Satellite Access Node classes | No impact |
| 4.5 Regional requirements | To be updated based on considered Regulations and impacted requirements |
| 4.6 Applicability of minimum requirements | No impact |
| 5. Operating bands and channel arrangement |  |
| 5.1 General | No impact |
| 5.2 Operating bands | The FR1-NTN band tables should be updated to consider the new NTN S-band. |
| 5.3 Satellite Access Node channel bandwidth |  |
| 5.3.1 General | No impact |
| 5.3.2 Transmission bandwidth configuration | No impact |
| 5.3.3 Minimum guardband and transmission bandwidth configuration | No impact |
| 5.3.4 RB alignment | No impact |
| 5.3.5 SAN channel bandwidth per operating band | The FR1-NTN channel bandwidth table should be updated to add the new S-band and supported channel BWs. |
| 5.4 Channel arrangement |  |
| 5.4.1 Channel spacing |  No impact |
| 5.4.2 Channel raster | The channel raster ranges should be added for the new NTN S-band in subclause 5.4.2.3 |
| 5.4.3 Synchronization raster | The sync raster ranges should be added for the new NTN S-band in subclause 5.4.3.3 |

**SAN Tx**So far, no impact on SAN Tx RF requirement has been identified, pending on further study of FCC and ISED regulations.

|  |  |
| --- | --- |
| Requirements | Expected impacts  |
| 6.1 General | No impact |
| 6.2 SAN output power | No impact |
| 6.3 Output power dynamics | No impact |
| 6.4 Transmit ON/OFF power | No impact |
| 6.5 Transmitted signal quality | No impact |
| 6.6 Unwanted emissions |  |
| 6.6.1 General | No impact |
| 6.6.2 Occupied bandwidth | No impact |
| 6.6.3 Adjacent Channel Leakage Power Ratio | No impact |
| 6.6.4 Out-of-band emissions | No impact |
| 6.6.5 Transmitter spurious emissions | No impact |
| 6.7 Transmitter intermodulation | No impact |

|  |  |
| --- | --- |
| Requirements | Expected impacts |
| 9.1 General | No impact |
| 9.2 Radiated transmit power | No impact |
| 9.3 OTA Satellite Access Node output power | No impact |
| 9.4 OTA output power dynamics | No impact |
| 9.5 OTA transmit ON/OFF power | No impact |
| 9.6 OTA transmitted signal quality | No impact |
| 9.7 OTA unwanted emissions |  |
| 9.7.1 General | No impact |
| 9.7.2 OTA occupied bandwidth | No impact |
| 9.7.3 OTA Adjacent Channel Leakage Power Ratio | No impact |
| 9.7.4 OTA out-of-band emissions | No impact |
| 9.7.5 OTA transmitter spurious emissions | No impact |
| 9.8 OTA transmitter intermodulation | No impact |

**SAN RX**[MODERATOR NOTE: The tables included in this section of the TDoc appear to refer to NTN Ku band. Clarification needed as to their applicability]As mentioned in our other contribution [2],MSS receivers operating in the 2000-2020 MHz frequency range shall accept interference from in-band power operations in the 1955-2000 MHz and from out of band emission in the 2000-2005 MHz (FCC CFR 47 25.265).So far, no other impact on SAN Rx RF requirement has been identified, pending on further study of FCC and ISED regulations |
| [**R4-2411196**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411196.zip) | Ericsson | This contribution is giving an overview of the impact on the existing UE RF requirements as specified in TS 38.101-5.**Proposal1: Clarify that the new NTN S-band is only targeting USA and Canada.****Observation1: The new S-band UL overlaps NTN band n256, TN TDD band n34, TN band n70 DL, TN band n65 UL and TN SUL band n95.****Observation2: The new S-band UL is only 5 MHz away from TN band n25 DL and 10 MHz away from TN band n2 DL.** **Observation3: The new S-band DL overlaps NTN band n256, TN bands n65 and n66 DL.**Figure 1: Adjacent and overlapping bands to the new NTN S-band**Proposal2:** **Consider the usual -50dBm/MHz UE coexistence requirement for the new S-band when protecting TN bands n25 and n2. Further discuss how to address coexistence with band n70.**RAN4 made some initial studies of the 2000-2020 MHz UL and 2180-2200 MHz DL frequency ranges in scope of the definition of a LTE band (band 23), the outcomes have been captured in TR 36.811 (5).During this study, A-MPR simulations were made using -50dBM/MHz to protect band n2 and -40dBm/MHz to protect the “G-block” which corresponds to the last 5 MHz of band n25, also reusing the additional emission mask specified with NS\_03. Further discussion would be needed to understand how to reuse those results.**Proposal3: Consider the EIRP density limit (FCC 47 CFR 25.216 (e)) and further study FCC and ISED regulations.****Proposal4: Specify the new NTN S-band with band number n252.**

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n252 | 2000 MHz – 2020 MHz | 2180 MHz – 2200 MHz | FDD |

**With the following channel BW and SCS:**

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | **30****(NOTE)** |
|  | 15 | 5 | 10 | 15 | 20 |  |
| n252 | 30 |  | 10 | 15 | 20 |  |
|  | 60 |  | 10 | 15 | 20 |  |

**Proposal5: Specify the following NR-ARFCN for band n252 in table 5.4.2.3-2:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| n252 | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 | Yes |

**Proposal6: Specify the following GSCN for band n252 in table 5.4.3.3-1:**

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | SS Block SCS | SS Block pattern1 | Range of GSCN(First – <Step size> – Last) |
| n252 | 15 kHz | Case A | 5456 – <1> – 5494 |

 |
| [**R4-2411303**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411303.zip) | EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint | **Proposal 1**: Band number [n252] for NR-NTN and [B252] for IoT-NTN are defined for the new NTN S-band.Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 – 1626.5 MHz | 2483.5 – 2500 MHz | FDD |
| n253 | Reserved for extended L band in NR |  |
| n252 | 2000 – 2020 MHz | 2180 – 2200 MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

**Observation 1**: General requirements can be re-used and most of band-specific requirements for n256/B256 can be re-used.Table 3: Required changes compare to current spec TS 38.101-5 [3] (Note: applicable to respective sections of TS 36.102)

|  |  |  |
| --- | --- | --- |
| Section | Requirement | Proposal for NR-NTN (Note: applicable also for IoT-NTN in respective sections of TS36.102) |
| **Tx requirements** |
| 6.2.1 | UE maximum output power | As proposed in the WID [1,2](PC3 for NR-NTN, PC3 and PC5 for IoT-NTN) |
| 6.2.2 | UE maximum output power reduction | No changes  |
| 6.2.3 | UE additional maximum output power reduction | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.2.4 | Configured transmitted power | No changes |
| 6.3.1 | Minimum output power | No changes |
| 6.3.2 | Transmit OFF power | No changes |
| 6.3.3 | Transmit ON/OFF time mask | No changes |
| 6.3.4 | Power control | No changes |
| 6.4 | Transmit signal quality | No changes |
| 6.5.1 | Occupied bandwidth | No changes |
| 6.5.2 | Out of band emission (ACLR) | No changes |
| 6.5.3.1 | General Spurious emissions | No changes |
| 6.5.3.2 | Spurious emissions for UE co-existence | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.3.3 | Additional spurious emissions | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.4 | Transmit intermodulation | No changes |
| **Rx requirements** |
| 7.3 | Reference sensitivity | FFS |
| 7.4 | Maximum input level | No changes |
| 7.5 | Adjacent channel selectivity | No changes |
| 7.6.1 | General | No changes |
| 7.6.2 | In-band blocking | No changes |
| 7.6.3 | Out-of-band blocking | Reused from n256 |
| 7.6.4 | Narrow band blocking | Reused from n256 |
| 7.7 | Spurious response | No changes |
| 7.8 | Intermodulation characteristics | No changes |

**Observation 2:** The main issues that need to be addressed are: 1. Clarification of applicable Regulations related requirements and 2. DL TN band protection (UE coexistence) requirements.**Proposal 2**: It is proposed to capture the listed FCC CFR applicable for this band in the TR 38.863.**Proposal 3**: ATC is not applicable, hence out of scope for this work. **Proposal 4**: The same deployment scenario as listed in TR 38.863, and used for other NTN bands, be used for the new NTN S-band. **Observation 3:** TR 38.863 [5] refers to a separation distance of 1500 m between TN and NTN UEs. The UE-UE co-existence value of -50 dBm/MHz is based on a separation distance of 1m [4].**Proposal 5**: RAN4 should re-evaluate the requirements of -50 dBm/MHz for TN - NTN UE co-existence using realistic deployment scenarios and UE parameters.**Proposal 6**: As concluded in [5] and agreed to for n256 UL and n2/n25 DL in [6], coexistence for overlapping band between the proposed NTN S-band [n252/B252] and TN bands n70 and n66 downlinks DL be out of scope of this work. |
| [**R4-2411842**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411842.zip) | ZTE Corporation, Sanechips | **Proposal 1: Operating band and band numbering for the new NR-NTN FDD band can be defined as Table 2.1-1.** Table 2.1-1: NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n252] | 2000 MHz - 2020 MHz | 2180 MHz - 2200 MHz | FDD |

**S BAND****Proposal 2: Supported channel bandwidths and SCS for the new NR-NTN FDD band can be defined as Table 2.2-1.**Table 2.2-1: Channel bandwidths for each NTN satellite band in FR1-NTN

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 |
|  | 15 | 5 | 10 | 15 | 20 |
| [n252] | 30 |  | 10 | 15 | 20 |
|  | 60 |  | 10 | 15 | 20 |

**Proposal 3: Whether to support asymmetric channel bandwidths depends on operators’ input.****Proposal 4: NR-ARFCN for the new NR-NTN FDD band supporting 100 kHz and 10 kHz channel raster can be defined as Table 2.4-1 and Table 2.4-2, respectively.**Table 2.4-1: Applicable NR-ARFCN per operating band in FR1-NTN with 100 kHz channel rater

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 100 | 400000 – <20> – 404000 | 436000 – <20> – 440000 |

Table 2.4-2: Applicable NR-ARFCN per operating band in FR1-NTN with 10 kHz channel rater

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| [n252] | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 | Yes |

**Proposal 5: We propose that at least case A SSB pattern is supported by the new NR-NTN FDD band, and case B SSB pattern also can be supported. Sync raster and GSCN for the new NR-NTN FDD band can be defined as Table 2.4-4.**Table 2.4-4: Applicable SS raster entries per operating band (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| [n252] | 15 kHz | Case A | 5456 – <1> – 5494 |
|  | 30 kHz | Case B | 5460 – <1> – 5488 |

**Proposal 6: The default TX-RX frequency separation for the new NR-NTN FDD band should be defined as Table 2.5-1.**Table 2.5-1: UE TX-RX frequency separation (FR1-NTN)

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [n252] | 180 MHz |

**Proposal 7: To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN FDD band.****Table 2.6-1 UE RF requirements for the new NR-NTN FDD band**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new NR-NTN FDD band** |
| 6.2.1 UE maximum output power | Band specific --> Specification impact. Support UE Power class 3 (+23dBm). |
| 6.2.2 MPR | Not band specific --> No specification impact. |
| 6.2.3 A-MPR | Band specific --> Specification impact. Considering use the same A-MPR requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.2.4 Configured transmitted power | Not band specific --> No specification impact. |
| 6.3.1 Minimum output power | Not band specific --> No specification impact. |
| 6.3.2 Transmit OFF power | Not band specific --> No specification impact. |
| 6.3.3 Transmit ON/OFF time mask | Not band specific --> No specification impact. |
| 6.3.4 Power control | Not band specific --> No specification impact. |
| 6.4.1 Frequency error | Not band specific --> No specification impact. |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5.1 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.5.2.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5.2.3 Additional Spectrum emission mask | Specification impact.Considering define the same additional SEM requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.5.2.4.1 NR ACLR | Not band specific --> No specification impact. |
| 6.5.2.4.2 UTRA ACLR | Not band specific --> No specification impact. |
| 6.5.3.1 General spurious emissions | Not band specific --> No specification impact. |
| 6.5.3.2 Spurious emissions for UE co-existence | Specification impact. Band [n252] needs to be added in Table 6.5.3.2-1. |
| 6.5.3.3 Additional spurious emissions | Specification impact.Considering define the same additional spurious emissions requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.5.4 Transmit intermodulation | Not band specific --> No specification impact. |
| 7.3.2 Reference sensitivity  | Band specific --> Specification impact. Considering use the same REFSENS requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 7.4 Max input level | Not band specific --> No specification impact. |
| 7.5 Adjacent channel selectivity | Not band specific --> No specification impact. |
| 7.6.2 In-band blocking | Specification impact --> Define in-band blocking requirement similar to band n254, n255, n256. |
| 7.6.3 Out of band blocking  | Specification impact --> Considering use the same out-of-band blocking requirement for band [n252] as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 7.6.4 Narrow band blocking | Specification impact --> Define narrow band blocking requirement similar to band n254, n255, n256. |
| 7.7 Spurious response | Not band specific --> No specification impact. |
| 7.8 Intermodulation characteristics | Not band specific --> No specification impact. |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

 |
| [**R4-2411843**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411843.zip) | ZTE Corporation, Sanechips | **Proposal 1: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN S-band.****Table 1: SAN RF requirements for the new NR-NTN S-band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN S-band** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN --> No specification impact. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar to band n254, n255, n256. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN --> No specification impact. |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN --> No specification impact. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN --> No specification impact. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |
| 7.8 In-channel selectivity | Not band specific --> No specification impact. |

 |
| [**R4-2411844**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411844.zip) | ZTE Corporation, Sanechips | **Title:** draftCR to TS38.108 Introduction of NR-NTN S band**Type:** Draft CR (Cat. B)**Target Spec:** TS 38.108**Reason:** Introduction of NR-NTN S band.**Summary of change:**Relevant sections for NR-NTN S band are updated.* 5.2, 5.3.5, 5.4.2.3, 5.4.3.3
 |
| [**R4-2412959**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412959.zip) | Huawei, HiSilicon | **Observation 1: the UL frequency range 2000 – 2020 MHz is overlapping with the DL frequency range 1995 ~ 2020 MHz of band n70.****Observation 2: The first adjacent channel interference from UL 2000 – 2020 MHz will fall into the DL frequency of band n25/n2.****Proposal 1: RAN4 need to discuss how to specify the UE-to-UE coexistence requirements between UL 2000 – 2020 MHz and other DL frequency range of band n2/n25/n70.****Proposal 2: RAN4 can discuss whether the additional power reduction is needed or not in order to comply with the regulatory requirements in the protected frequency range 1559 ~ 1610 MHz.** |
| [**R4-2413146**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413146.zip) | Qualcomm Incorporated | **Workplan**

|  |  |
| --- | --- |
| Meeting |  |
| RAN4#112Aug’24 | Discussions on* Regulatory requirements and co-existence requirements
* Specification impact, e.g. which requirements can be re-used from earlier bands
* Workplan

Agreements on* Workplan on RF core requirements
* Specification impact
 |
| RAN4#112bisOct’24 | Discussions on* (continued) Regulatory requirements and co-existence requirements
* Other UE and SAN RF requirements (e.g. refsens)
* System parameters

Agreements on* Regulatory requirements and co-existence requirements
 |
| RAN4#113Nov’24 | Discussions on * A-MPR evaluation results, if necessitated by the outcome on regulatory and co-existence requirements
* BS conformance testing requirements (perf part)
* (continued) UE and SAN RF requirements

Agreements on* UE and SAN RF requirements (e.g. refsens)
 |
| RAN4#114Feb’25 | Discussions on* (Continued) BS conformance testing requirements
* (Continued) any remaining UE RF requirements
* draftCR or CR contents

Agreements on* A-MPR (if needed)
* Remaining UE and SAN RF requirements, including SAN conformance testing requirements
* Endorsement of draft CRs (running CRs)

  |
| RAN4#114bisApr’25 | Discussions on* draftCR or CR contents
* RRM and demodulation requirements

Agreements on* Endorsement of draft CRs
 |
| RAN4#115May’25 | Discussions on* Finalization of any remaining issues, if any

Agreements on* Approval of all CRs
 |

**Proposal 1: Agree on the workplan as presented in this contribution.** |
| [**R4-2413147**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413147.zip) | Qualcomm Incorporated | **Proposal 1: Co-existence work regarding co-existence with other 3GPP bands can be focused on NTN UE Tx interference to DL of n2 and n25.** **Observation 1: 3GPP has multiple examples of less stringent than -50 dBm/MHz UE-to-UE co-existence requirements.****Observation 2: 3GPP assumes geographical separation between NTN and TN networks in co-existence studies.****Observation 3: UE-to-UE co-existence requirements between new S-band and DL of n2 and n25 should provide protection to n2 and n25 DL.** **Proposal 2: Further work is needed to set appropriate UE-to-UE co-existence requirements towards n2 and n25 DL, as it is not obvious what limit should be applied.** |
| [**R4-2413305**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413305.zip) | T-Mobile USA | **Observation 1: Regulators typically keep uplink next to uplink and downlink next to downlink for adjacent or nearby bands to minimize interference issues.** **Observation 2: In the case of NTN band B256/n256, the uplink is adjacent to the B1/n1 uplink and overlaps with the B65/n65 uplink, and the B256 DL is adjacent to the B1/n1 uplink and overlaps with the B65/n65 DL.****Observation 3: For the proposed S-Band, the uplink overlaps with the n70 downlink and is only 5 MHz above the n25 downlink, and 10 MHz above the n2 downlink.****Observation 4: In the US, LTE Band 23 was deprecated in favor of Band 70 and n70 which coexists better with Band2/n2 and Band 25/n25.** **Observation 5: While coexistence between the proposed S-Band uplink that the Band 2/n2, Band 25/n25 downlinks will be challenging, coexistence between the S-Band uplink and the Band 70/70 downlink will likely be impossible for the same geographic region.****Observation 6: As terrestrial deployments in B70/n70 expand, it will become more difficult to achieve adequate coexistence between the S-Band and Band70/n70.** **Observation 7: In dense urban, urban, suburban and rural areas, the incidence of UE-UE interference between the S-Band and terrestrial bands must be considered.** **Observation 8: Compared to terrestrial UEs, coexistence studies need to consider that it is more likely that NTN UEs will be operating at maximum power****Observation 9: It is unlikely that a satellite network would use NS signalling because the A-MPR could prevent the link budget from closing.****Proposal 1: The proponents should discuss with regulators the possibility of using the Band 70/n70 uplink/downlink configuration for satellite NTN, rather than 2000-2020 MHz UL, 2180-2200 DL.** **Proposal 2: The baseline protection level for emissions into 1990-1995 should be -50 dBm/MHz.** **Proposal 3: RAN4 should consider banning certain problematic uplink RB configurations to minimize the chances of causing unacceptable levels of interference into neighboring downlink bands.**Table 1: S-band allowed allocations

|  |  |
| --- | --- |
| **Channel Bandwidth [MHz]** | **Parameters** |
| 5 | * Fc [MHz]
 | < 2007.5 | 2007.5 ≤ Fc < 2012.5 | 2012.5 ≤ Fc ≤ 2017.5 |
| * RBstart
 | ≤24 | 0-3 | 4-6 | ≤24 |
| * LCRB [RBs]
 | >0 | 15-19 | ≥20 | ≥18 | 1-25 |
| Allowed/Not allowed | Not allowed | Allowed | Allowed | Allowed | Allowed |
| 10 | * Fc [MHz]
 | 2005 |
| * RBstart
 | 0-25 | 26-34 | 35-49 |
| * LCRB [RBs]
 | >0 | 8-15 | >15 | >0 |
| Allowed/Not allowed | Not allowed | Allowed | Allowed | Allowed |
| * Fc [MHz]
 | 2015 |
| * RBstart
 | 0-5 | 6-10 |
| * LCRB [RBs]
 | ≥32 | ≥40 |
| Allowed/Not allowed | Allowed | Allowed |
| 15 | * Fc [MHz]
 | 2012.5 |
| * RBstart
 | 0-14 | 15-24 | 25-39 | 61-74 |
| * LCRB [RBs]
 | 1-9 & 40-75 | 10-39 | 24-29 | ≥30 | ≥36 | ≤6 |
| Allowed/Not allowed | Not allowed | Allowed | Allowed | Allowed | Allowed | Allowed |
| 20 | * Fc [MHz]
 | 2010 |
| * RBstart
 | 0-21 | 22-31 | 32-38 | 39-49 | 50-68 | 69-99 |
| * LCRB [RBs]
 | >0 | 1-9 & 31-75 | 10-30 | ≥15 | ≥24 | ≥25 | >0 |
| Allowed/Not allowed | Not allowed | Not allowed | Allowed | Allowed | Allowed | Allowed | Not allowed |

 |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1: Work Plan

*Sub-topic description:*

*Work plan for NR\_NTN\_Sband*

*Open issues and candidate options before meeting:*

#### Issue 1-1: Proposed Work Plan

* Proposals
	+ Option 1:

|  |  |
| --- | --- |
| Meeting |  |
| RAN4#112Aug’24 | Discussions on* Regulatory requirements and co-existence requirements
* Specification impact, e.g. which requirements can be re-used from earlier bands
* Workplan

Agreements on* Workplan on RF core requirements
* Specification impact
 |
| RAN4#112bisOct’24 | Discussions on* (continued) Regulatory requirements and co-existence requirements
* Other UE and SAN RF requirements (e.g. refsens)
* System parameters

Agreements on* Regulatory requirements and co-existence requirements
 |
| RAN4#113Nov’24 | Discussions on * A-MPR evaluation results, if necessitated by the outcome on regulatory and co-existence requirements
* BS conformance testing requirements (perf part)
* (continued) UE and SAN RF requirements

Agreements on* UE and SAN RF requirements (e.g. refsens)
 |
| RAN4#114Feb’25 | Discussions on* (Continued) BS conformance testing requirements
* (Continued) any remaining UE RF requirements
* draftCR or CR contents

Agreements on* A-MPR (if needed)
* Remaining UE and SAN RF requirements, including SAN conformance testing requirements
* Endorsement of draft CRs (running CRs)

  |
| RAN4#114bisApr’25 | Discussions on* draftCR or CR contents
* RRM and demodulation requirements

Agreements on* Endorsement of draft CRs
 |
| RAN4#115May’25 | Discussions on* Finalization of any remaining issues, if any

Agreements on* Approval of all CRs
 |

* + Option 2: Other
* Recommended WF
	+ Agree to the proposed Work plan in Option 1.

### Sub-topic 1-2: General Aspects

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 1-2-1: Band Numbering

* **Proposals**
	+ Option 1: n252 (CATT, Ericsson, [EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint], [ZTE, Sanechips])
	+ Option 2: Other
* **Recommended WF**
	+ Adopt n252 as the band number for the new NR NTN S-band.

#### Issue 1-2-2: Band Plan

* **Proposals**
	+ Option 1: Proposed band plan as follows (CATT, Ericsson, [EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint], [ZTE, Sanechips])

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite operating band | Uplink (UL) operating bandSAN receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSAN transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| [n252] | 2000 MHz - 2020 MHz  | 2180 MHz - 2200MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from n256. |

* + Option 2: The proponents should discuss with regulators the possibility of using the Band 70/n70 uplink/downlink configuration for satellite NTN, rather than 2000-2020 MHz UL, 2180-2200 DL (T-Mobile USA)
* **Recommended WF**
	+ Agree to Option 1 as a starting point.

#### Issue 1-2-3: Intended Regions and Countries

* **Proposals**
	+ Option 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, RAN4 should clarify the intended regions and/or countries where the new NTN bands deployed (CATT)
	+ Option 2: Clarify that the new NTN S-band is only targeting USA and Canada. (Ericsson)
	+ Option 2: Other
* **Recommended WF**
	+ Further discuss and clarify the applicable regions and countries for this new NTN band.

#### Issue 1-2-4: Regulatory Background

* **Proposals**
	+ Proposal 1: Consider the EIRP density limit (FCC 47 CFR 25.216 (e)) and further study FCC and ISED regulations (Ericsson)
	+ Proposal 2: It is proposed to capture the listed FCC CFR applicable for this band in the TR 38.863. (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Proposal 3: ATC is not applicable, hence out of scope for this work (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Proposal 4: RAN4 can discuss whether the additional power reduction is needed or not in order to comply with the regulatory requirements in the protected frequency range 1559 ~ 1610 MHz. (Huawei/HiSilicon)
	+ Proposal 5: Other
* **Recommended WF**
	+ Consider if Proposal 1, Proposal 2 and Proposal 3 can be agreed as a starting point.
	+ Further discuss Proposal 4
	+ Applicable regulations can be further discussed after the applicable regions and countries for this band have been agreed,
	+ Applicable regulation shall be captured in a new NTN S-band section in TR 38.863.

#### Issue 1-2-5: Applicable TN Bands for Coexistence

* **Proposals**
	+ Option 1: n2 and n25. Further discuss for band n70 (Ericsson)
	+ Option 2: S-band UL with n2 and n25 DL only. n70 and n66 downlinks DL should be out of scope (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Option 3: S-band UL and n2, n25 and n70 DL (Huawei/HiSilicon)
	+ Option 4: Focus on NTN UE Tx interference to DL of n2 and n25 (Qualcomm)
	+ Option 5: S-band UL with B2/n2, B25/n25 and B70/n70 DL (T-Mobile USA)
	+ Option 6: Other
* **Recommended WF**
	+ Focus on coexistence of S-band UL with B2/n2 and B25/n25 DL. Further discuss whether coexistence of S-band UL with B70/n70 DL should be in scope.
	+ Further discuss how to address coexistence after the applicable bands have been agreed.

#### Issue 1-2-6: TN-NTN UE-to-UE Coexistence

* **Proposals**
	+ Option 1: Consider the usual -50dBm/MHz UE coexistence requirement for the new S-band when protecting TN bands n25 and n2. Further discuss how to address coexistence with band n70 (Ericsson)
	+ Option 2: RAN4 should re-evaluate the requirements of -50 dBm/MHz for TN - NTN UE co-existence using realistic deployment scenarios and UE parameters. (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Option 3: To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN FDD band (ZTE Corporation, Sanechips)
		- *MODERATOR NOTE: This contribution appears to propose to consider reusing requirements from B23, 256, 255, 254 as a baseline – Please See table in Companies Contributions Summary*.
	+ Option 4: (T-Mobile USA)
		- Proposal 1: The baseline protection level for emissions into 1990-1995 should be -50 dBm/MHz.
		- Proposal 2: RAN4 should consider banning certain problematic uplink RB configurations to minimize the chances of causing unacceptable levels of interference into neighboring downlink bands
	+ Option 4: Other
* **Recommended WF**
	+ Further discuss TN-NTN UE-to-UE coexistence aspects and whether -50dBm/MHz should be reused or whether the requirements should be revisited for the new NTN S-band
	+ Consider whether coexistence assumptions and requirements from B23 can be reused
	+ The outcome of the coexistence assessments should be captured in a new NTN S-band section in TR 38.863.

#### Issue 1-2-7: Additional Coexistence Aspects

* **Proposals**
	+ Option 1: RAN4 can discuss whether the additional power reduction is needed or not in order to comply with the regulatory requirements in the protected frequency range 1559 ~ 1610 MHz. (Huawei/HiSilicon)
	+ Option 2: Other
* **Recommended WF**
	+ Further discuss applicability of protection of the 1559 ~ 1610 MHz range

### Sub-topic 1-3: System Parameters and UE RF

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 1-3-1: UE Channel Bandwidths

* Proposals
	+ Option 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel bandwidth and SCS should be defined as follows (CATT, Ericsson, ZTE Corporation, Sanechips):

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 |
|  | 15 | 5 | 10 | 15 | 20 |
| [n252] | 30 |  | 10 | 15 | 20 |
|  | 60 |  | 10 | 15 | 20 |

* + Option 2: Whether to support asymmetric channel bandwidths depends on operators’ input. (ZTE Corporation, Sanechips)
	+ Option 3: Other
* **Recommended WF**
	+ Consider Option 1 as a starting point and further discuss whether to support asymmetric channel bandwidths.

#### Issue 1-3-2: Channel Raster

* **Proposals**
	+ Option 1: Specify both 100 kHz and 10 kHz channel raster as follows:
		- For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel raster should be defined as Table 2.3-1 and Table 2.3-2 (CATT)

Table 2.3-1: Applicable NR-ARFCN per *operating band* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 100 | 400000 – <20> – 404000 | 436000 – <20> – 440000 |

Table 2.3-2: Applicable NR-ARFCN per *operating band* for enhanced channel raster

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 |

* + Option 2: Specify both 100 kHz and 10 kHz channel raster as follows, with Mandatory support for Enhanced Channel Raster:
		- NR-ARFCN for the new NR-NTN FDD band supporting 100 kHz and 10 kHz channel raster can be defined as Table 2.4-1 and Table 2.4-2, respectively (ZTE Corporation, Sanechips)

Table 2.4-1: Applicable NR-ARFCN per operating band in FR1-NTN with 100 kHz channel rater

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n252] | 100 | 400000 – <20> – 404000 | 436000 – <20> – 440000 |

Table 2.4-2: Applicable NR-ARFCN per operating band in FR1-NTN with 10 kHz channel rater

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| [n252] | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 | Yes |

* + Option 3: Specify only 10 kHz channel raster as follows, with Mandatory support for Enhanced Channel Raster:
		- Specify the following NR-ARFCN for band n252 in table 5.4.2.3-2 (Ericsson):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| n252 | 10 | 400000 – <2> – 404000 | 436000 – <2> – 440000 | Yes |

* **Recommended WF**
	+ Agree on support for Enhanced 10 kHz Channel Raster.
	+ Agree to mark Enhanced Channel Raster support as Mandatory as agreed in the WID Objectives.
	+ Further discuss whether to support both 100 kHz and 10 kHz channel raster.
	+ Accordingly consider either Option 1, Option 2 or Option 3 value sets as starting point.

#### Issue 1-3-3: Sync Raster

* **Proposals**
	+ Option 1: Specify only Case A for the new NTN S-band GSCN, based on the following proposals:
		- For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the synchronization raster should be defined as Table 2.4-1.
* Table 2.4-1: Applicable SS raster entries per *operating band* (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| n256 | 15 kHz | Case A | 5429 – <1> – 5494 |
| n255 | 15 kHz | Case A | 3818 – <1> – 3892 |
|  | 30 kHz | Case B | 3824 – <1> – 3886 |
| n254 | 15 kHz | Case A | 6215 – <1> – 6244 |
|  | 30kHz | Case C | 6218 – <1> – 6241 |
| [n252] | 15 kHz | Case A | 5456 – <1> – 5494 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [7]. |

* + - Specify the following GSCN for band n252 in table 5.4.3.3-1 (Ericssson)

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | SS Block SCS | SS Block pattern1 | Range of GSCN(First – <Step size> – Last) |
| n252 | 15 kHz | Case A | 5456 – <1> – 5494 |

* + Option 2: Specify both Case A and Case B for the new NTN S-band GSCN, based on the following proposals:
		- We propose that at least case A SSB pattern is supported by the new NR-NTN FDD band, and case B SSB pattern also can be supported. Sync raster and GSCN for the new NR-NTN FDD band can be defined as Table 2.4-4 (ZTE Corporation, Sanechips):

Table 2.4-4: Applicable SS raster entries per operating band (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| [n252] | 15 kHz | Case A | 5456 – <1> – 5494 |
|  | 30 kHz | Case B | 5460 – <1> – 5488 |

* + Option 3: Other
* **Recommended WF**
	+ Agree on specifying at least Case A for the new NTN S-band GSCN.
	+ Further discuss whether to support Case B and/or other cases.
	+ Accordingly consider the proposed values as a starting point.

#### Issue 1-3-4: TX-RX Separation

* **Proposals**
	+ Option 1: Define the Default TX-RX Separation for the new NTN S-band as follows:

Table 2.5-1: UE TX-RX frequency separation (FR1-NTN)

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [n252] | 180 MHz |

* + Option 2: Other
* **Recommended WF**
	+ Consider Option 1 as a starting point for further discussion.

#### Issue 1-3-5: UE Power Class

* **Proposals**
	+ Option 1: Specify UE Power Class based on the following proposals:
		- For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the maximum output power should be defined as Table 2.6-1 (CATT).
* Table 2.6-1: UE Power Class

|  |  |  |
| --- | --- | --- |
| NR satellite band | Class 3 (dBm) | Tolerance (dB) |
| [n252] | 23 | ±2 |
| NOTE 1: PPowerClass is the maximum UE power specified without taking into account the toleranceNOTE 2: Powerclass 3 is default power class unless otherwise stated |

* + - Proposal for NR-NTN (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint)

|  |  |  |
| --- | --- | --- |
| 6.2.1 | UE maximum output power | As proposed in the WID [1,2](PC3 for NR-NTN, PC3 and PC5 for IoT-NTN) |

* + - To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN FDD band (ZTE Corporation, Sanechips)

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new NR-NTN FDD band** |
| 6.2.1 UE maximum output power | Band specific --> Specification impact. Support UE Power class 3 (+23dBm). |

* + Option 2: Other
* **Recommended WF**
	+ Consider Option 1 proposals as a starting point, further discuss the details.

#### Issue 1-3-6: General views on Impact to UE Requirements

* **Proposals**
	+ Option 1: Reuse the following requirements as per Table 3 (EchoStar, Dish Network, TerreStar, Thales, Gatehouse, Novamint):

Table 3: Required changes compare to current spec TS 38.101-5 [3]
(Note: applicable to respective sections of TS 36.102)

|  |  |  |
| --- | --- | --- |
| Section | Requirement | Proposal for NR-NTN (Note: applicable also for IoT-NTN in respective sections of TS36.102) |
| **Tx requirements** |
| 6.2.1 | UE maximum output power | As proposed in the WID [1,2](PC3 for NR-NTN, PC3 and PC5 for IoT-NTN) |
| 6.2.2 | UE maximum output power reduction | No changes  |
| 6.2.3 | UE additional maximum output power reduction | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.2.4 | Configured transmitted power | No changes |
| 6.3.1 | Minimum output power | No changes |
| 6.3.2 | Transmit OFF power | No changes |
| 6.3.3 | Transmit ON/OFF time mask | No changes |
| 6.3.4 | Power control | No changes |
| 6.4 | Transmit signal quality | No changes |
| 6.5.1 | Occupied bandwidth | No changes |
| 6.5.2 | Out of band emission (ACLR) | No changes |
| 6.5.3.1 | General Spurious emissions | No changes |
| 6.5.3.2 | Spurious emissions for UE co-existence | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.3.3 | Additional spurious emissions | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.4 | Transmit intermodulation | No changes |
| **Rx requirements** |
| 7.3 | Reference sensitivity | FFS |
| 7.4 | Maximum input level | No changes |
| 7.5 | Adjacent channel selectivity | No changes |
| 7.6.1 | General | No changes |
| 7.6.2 | In-band blocking | No changes |
| 7.6.3 | Out-of-band blocking | Reused from n256 |
| 7.6.4 | Narrow band blocking | Reused from n256 |
| 7.7 | Spurious response | No changes |
| 7.8 | Intermodulation characteristics | No changes |

* + Option 2: To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN FDD band. (ZTE Corporation, Sanechips)

**Table 2.6-1 UE RF requirements for the new NR-NTN FDD band**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new NR-NTN FDD band** |
| 6.2.1 UE maximum output power | Band specific --> Specification impact. Support UE Power class 3 (+23dBm). |
| 6.2.2 MPR | Not band specific --> No specification impact. |
| 6.2.3 A-MPR | Band specific --> Specification impact. Considering use the same A-MPR requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.2.4 Configured transmitted power | Not band specific --> No specification impact. |
| 6.3.1 Minimum output power | Not band specific --> No specification impact. |
| 6.3.2 Transmit OFF power | Not band specific --> No specification impact. |
| 6.3.3 Transmit ON/OFF time mask | Not band specific --> No specification impact. |
| 6.3.4 Power control | Not band specific --> No specification impact. |
| 6.4.1 Frequency error | Not band specific --> No specification impact. |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5.1 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.5.2.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5.2.3 Additional Spectrum emission mask | Specification impact.Considering define the same additional SEM requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.5.2.4.1 NR ACLR | Not band specific --> No specification impact. |
| 6.5.2.4.2 UTRA ACLR | Not band specific --> No specification impact. |
| 6.5.3.1 General spurious emissions | Not band specific --> No specification impact. |
| 6.5.3.2 Spurious emissions for UE co-existence | Specification impact. Band [n252] needs to be added in Table 6.5.3.2-1. |
| 6.5.3.3 Additional spurious emissions | Specification impact.Considering define the same additional spurious emissions requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 6.5.4 Transmit intermodulation | Not band specific --> No specification impact. |
| 7.3.2 Reference sensitivity  | Band specific --> Specification impact. Considering use the same REFSENS requirement as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 7.4 Max input level | Not band specific --> No specification impact. |
| 7.5 Adjacent channel selectivity | Not band specific --> No specification impact. |
| 7.6.2 In-band blocking | Specification impact --> Define in-band blocking requirement similar to band n254, n255, n256. |
| 7.6.3 Out of band blocking  | Specification impact --> Considering use the same out-of-band blocking requirement for band [n252] as LTE band 23 as a starting point since operating band of the new NR-NTN FDD band is same as B23. |
| 7.6.4 Narrow band blocking | Specification impact --> Define narrow band blocking requirement similar to band n254, n255, n256. |
| 7.7 Spurious response | Not band specific --> No specification impact. |
| 7.8 Intermodulation characteristics | Not band specific --> No specification impact. |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

* + Option 3: Other
* **Recommended WF**
	+ Postpone discussion after agreement on general regulatory background and coexistence has been reached.

### Sub-topic 1-4: SAN RF

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 1-4-1: SAN System Parameters Requirements Impact

* **Proposals**
	+ Option 1:
		- For TS 38.108, no RF requirements impact by introducing the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz. The existing SAN type 1-H and 1-O RF requirements are applicable to new band. (CATT)
		- System Parameters (Ericsson)

|  |  |
| --- | --- |
| Requirements | Expected impact |
| 4. General |  |
| 4.1 Relationship with other core specifications | No impact |
| 4.2 Relationship between minimum requirements and test requirements | No impact |
| 4.3 Requirement reference points | No impact |
| 4.4 Satellite Access Node classes | No impact |
| 4.5 Regional requirements | To be updated based on considered Regulations and impacted requirements |
| 4.6 Applicability of minimum requirements | No impact |
| 5. Operating bands and channel arrangement |  |
| 5.1 General | No impact |
| 5.2 Operating bands | The FR1-NTN band tables should be updated to consider the new NTN S-band. |
| 5.3 Satellite Access Node channel bandwidth |  |
| 5.3.1 General | No impact |
| 5.3.2 Transmission bandwidth configuration | No impact |
| 5.3.3 Minimum guardband and transmission bandwidth configuration | No impact |
| 5.3.4 RB alignment | No impact |
| 5.3.5 SAN channel bandwidth per operating band | The FR1-NTN channel bandwidth table should be updated to add the new S-band and supported channel BWs. |
| 5.4 Channel arrangement |  |
| 5.4.1 Channel spacing |  No impact |
| 5.4.2 Channel raster | The channel raster ranges should be added for the new NTN S-band in subclause 5.4.2.3 |
| 5.4.3 Synchronization raster | The sync raster ranges should be added for the new NTN S-band in subclause 5.4.3.3 |

* + - To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN S-band.
		- sds
	+ Option 2: System Parameters
* Recommended WF
	+ TBA

#### Issue 1-4-2: SAN Channel Bandwidth

* **Proposals**
	+ Option 1: For the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz, the channel bandwidth and SCS should be defined as Table 2.2-1

Table 2.2-1: *SAN channel bandwidths* and SCS per *operating band* in FR1

| SAN Operating Band | SCS (kHz) | *SAN channel bandwidth* (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 |
|  | 15 | 5 | 10 | 15 | 20 |
| [n252] | 30 |  | 10 | 15 | 20 |
|  | 60 |  | 10 | 15 | 20 |

* + Option 2: TBA
* **Recommended WF**
	+ TBA

#### Issue 1-4-3: SAN TX Requirements Impact

* **Proposals**
	+ Option 1: For TS 38.108, no RF requirements impact by introducing the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz. The existing SAN type 1-H and 1-O RF requirements are applicable to new band (CATT)
	+ Option 2: So far, no impact on SAN Tx RF requirement has been identified, pending on further study of FCC and ISED regulations (Ericsson)
	+ Option 3: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN S-band (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new NR-NTN S-band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN S-band** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN --> No specification impact. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar to band n254, n255, n256. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN --> No specification impact. |

* + Option 4: TBA
* **Recommended WF**
	+ TBA

#### Issue 1-4-4: SAN RX Requirements Impact

* **Proposals**
	+ Option 1: For TS 38.108, no RF requirements impact by introducing the NTN FDD band with UE transmitting at 2000 - 2020 MHz and SAN transmitting at 2180 - 2200 MHz. The existing SAN type 1-H and 1-O RF requirements are applicable to new band (CATT)
	+ Option 2: (Ericsson)
		- As mentioned in our other contribution [2],MSS receivers operating in the 2000-2020 MHz frequency range shall accept interference from in-band power operations in the 1955-2000 MHz and from out of band emission in the 2000-2005 MHz (FCC CFR 47 25.265).
		- So far, no other impact on SAN Rx RF requirement has been identified, pending on further study of FCC and ISED regulations
	+ Option 3: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN S-band (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new NR-NTN S-band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN S-band** |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN --> No specification impact. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN --> No specification impact. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |
| 7.8 In-channel selectivity | Not band specific --> No specification impact. |

* + Option 2: TBA
* **Recommended WF**
	+ TBA

# Topic #2: IoT\_NTN\_FDD\_S\_band

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411304**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411304.zip) | EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint | **Proposal 1**: Band number [n252] for NR-NTN and [B252] for IoT-NTN are defined for the new NTN S-band.Table 2: E-UTRA operating bands for satellite access

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 256 | 1980 MHz | – | 2010 MHz | 2170 MHz | – | 2200 MHz | FDD |
| 255 | 1626.5 MHz | – | 1660.5 MHz | 1525 MHz | – | 1559 MHz | FDD |
| 254 | 1610 MHz | - | 1626.5 MHz | 2483.5 MHz | - | 2500 MHz | FDD |
| 2532 | 1668 MHz | - | 1675 MHz | 1518 MHz | - | 1525 MHz | FDD |
| 252 | 2000 MHz | - | 2020 MHz | 2180 MHz | - | 2200 MHz | FDD |
| NOTE 1: Satellite bands are numbered in descending order from 256NOTE 2: UE assigned to channels and allocated frequency resources in the lower portion of Band 253 may experience blocking or harmful interference from terrestrial networks in adjacent or nearby frequencies when operating in the proximity with terrestrial base stations. |

**Observation 1**: General requirements can be re-used and most of band-specific requirements for n256/B256 can be re-used.**Observation 2:** The main issues that need to be addressed are: 1. Clarification of applicable Regulations related requirements and 2. DL TN band protection (UE coexistence) requirements.**Proposal 2**: It is proposed to capture the listed FCC CFR applicable for this band in the TR 38.863.**Proposal 3**: ATC is not applicable, hence out of scope for this work. **Proposal 4**: The same deployment scenario as listed in TR 38.863, and used for other NTN bands, be used for the new NTN S-band. **Observation 3:** TR 38.863 [5] refers to a separation distance of 1500 m between TN and NTN UEs. The UE-UE co-existence value of -50 dBm/MHz is based on a separation distance of 1m [4].**Proposal 5**: RAN4 should re-evaluate the requirements of -50 dBm/MHz for TN - NTN UE co-existence using realistic deployment scenarios and UE parameters.**Proposal 6**: As concluded in [5] and agreed to for n256 UL and n2/n25 DL in [6], coexistence for overlapping band between the proposed NTN S-band [n252/B252] and TN bands n70 and n66 downlinks DL be out of scope of this work. |
| [**R4-2411547**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411547.zip) | Mediatek India Technology Pvt. | **Proposal: Agree the proposed workplan for an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) spectrum WI for North America**2.1 RF Core-Part and SAN Conformance-Testing requirements**1) RAN4#112 (August 2024)**- General aspects.* Agreements on work plan

- Identification of the regulatory, UE coexistence, and RF-core requirements that need discussions.- To study whether some initial system parameters and RF requirements could be inherited from the existing IoT NTN and/or terrestrial IoT bands.* Agreements on some initial system parameters and RF requirements if applicable

**2) RAN4#112bis (****October 2024)**- Further discussions on * The regulatory requirements if necessary
* The UE coexistence requirements
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)

- If applicable, make agreements on regulatory and co-existence requirements.- If applicable, make agreements on further system parameters and RF requirements (e.g., REFSENS).**3) RAN4#113 (November 2024)**- Further discussions on * The regulatory and UE coexistence requirements if necessary
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)

- Discussions on * SAN conformance-testing requirements (perf part)

- Aiming at regulatory-requirements finalisation especially for TR 36.764- Aiming at RF-core requirements finalisation.- If applicable, make initial agreements on SAN conformance-testing requirements.- Endorse the draft CRs for the RF-core specifications especially for UE RF (e.g., TS 36.102, TR 36.764). **4) RAN4#114 (February 2025)**- Further discussions on * The regulatory and UE coexistence requirements if necessary
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)
* SAN conformance-testing requirements (perf part)

- Finalisation of the remaining RF-core requirements.- Agree SAN conformance-testing requirements.- Endorse the draft CRs for the rest core specifications.**5) RAN4#114bis (April 2025)**- Finalisation of the remaining issues if any. - Endorse the draft CRs for the remaining issues if any.**6) RAN4#115 (May 2025)**- Finalisation of the remaining issues if any. - Agree all the CRs.2.2 RRM Performance-Part requirements**1) RAN4#114bis (April 2025)**- Discussion on RRM performance requirements and test cases.- Aiming at RRM performance requirements and test cases finalization.- Agree the draft CRs for TS 36.133 if any.**2) RAN4#115 (May 2025)**- Finalisation of RRM performance requirements and test cases. - Agree all the CRs if any.2.3 UE and SAN Demodulation Performance-Part requirements **1) RAN4#114bis (April 2025)**- Discussion on UE and SAN demodulation requirements.* + If necessary, update the UE and SAN demodulation requirements.

- Aiming at finalization of UE and SAN demodulation requirements.- Agree the draft CR if any.**2) RAN4#115 (May 2025)**- Finalization of UE and SAN demodulation requirements.- Agree all the CRs if any.  |
| [**R4-2411548**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411548.zip) | Mediatek India Technology Pvt. | ***Proposal 1: Regarding band number, specify IoT-NTN band number [252] for an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) if feasible.*** TS 36.102 Table 5.2-1 E-UTRA operating bands for satellite access

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 256 | 1980 MHz | – | 2010 MHz | 2170 MHz | – | 2200 MHz | FDD |
| 255 | 1626.5 MHz | – | 1660.5 MHz | 1525 MHz | – | 1559 MHz | FDD |
| 254 | 1610 MHz | - | 1626.5 MHz | 2483.5 MHz | - | 2500 MHz | FDD |
| 2532 | 1668 MHz | - | 1675 MHz | 1518 MHz | - | 1525 MHz | FDD |
| [252] | 2000 MHz | - | 2020 MHz | 2180 MHz | - | 2200 MHz | FDD |

***Proposal 2: Regarding CBW, the addition of an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) does not have any impact on the CBW sub-clauses for category M1 or category NB1/NB2.******Proposal 3: As for an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), to set the default Tx-Rx frequency separation as fixed value first. Further study variable Tx-Rx frequency separation.******Observation 1: Regarding an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) UE RF requirements, to distinguish band-agnostic UE RF requirements from TS 36.102 [2] is provided in Table 2.3-1.******Proposal 4: To agree the proposals in the Table 2.3-1 if there is no specific concern, or at least use them as the starting point for further discussions on an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) UE TX and RX RF requirements.***

|  |  |  |  |
| --- | --- | --- | --- |
| **Requirement name** | **Band-agnostic?** | **Reuse 36.102 requirement?** | **Comments** |
| Clause 6: Transmitter Characteristics |  |  |  |
| 6.2A.1/6.2B.1:UE maximum output power | Yes | See comments | Discussion on Proposal 5.  |
| 6.2A.1/6.2B.1:UE maximum output power tolerance | See comments | See comments | Discussion on Proposal 5. |
| 6.2A.2/6.2B.2:UE maximum output power reduction | Yes | Yes | Different MPR tables for category M1 and NB1/NB2 separately.  |
| 6.2A.3/6.2B.3:UE additional maximum output power reduction | No | See comments | Need further discussion based on UE-UE coexistence analysis |
| 6.3: Output power dynamics | Yes | Yes |  |
| 6.4: Transmit signal quality | Yes | Yes |  |
| 6.5A.3.2/6.5B.3.2:Spectrum emission mask | Yes | Yes |  |
| 6.5A.3.4/6.5B.3.4:Adjacent Channel Leakage Ratio | Yes | Yes |  |
| 6.5A.4.3/6.5B.4.3:Spurious emissions for UE co-existence | No |  |  |
| 6.5A.4.4/6.5B.4.4:Additional spurious emissions | No |  |  |
| 6.6: Transmit intermodulation for category NB1 and NB2 | Yes | Yes |  |
| 7: Receiver characteristics |  |  |  |
| 7.2: Diversity characteristics | Yes | Yes |  |
| 7.3: Reference sensitivity power level | No | See comments | Because the new band’s 2180-2200 MHz DL frequency range is overlapping with band 256 DL, to consider putting band 256 REFSENS into square bracket as starting point for the new band.  |
| 7.4: Maximum input level | Yes | Yes |  |
| 7.5: Adjacent Channel Selectivity | Yes | Yes |  |
| 7.6A.2/7.6B.2:In-band blocking | No | Yes if there is no specific concern | Different band group may have different In-band blocking tables for Cat-M1 and NB1/NB2 separately. Currently, bands 256,255,254, and 253 apply the same IBB requirements.  |
| 7.6A.3/7.6B.3:Out-of-band blocking | No | See comments | Different Out-of-band requirements for IoT NTN bands; whether to leverage requirement from band 256 needs further discussion.  |
| 7.6A.4/7.6B.4:Narrow band blocking | No | Yes if there is no specific concern |  |
| 7.7: Spurious response | Yes | Yes |  |
| 7.8: Intermodulation characteristics | Yes | Yes |  |
| 7.9: RX spurious emission | No | Yes if there is no specific concern |  |

***Observation 2: In TS 36.102 [2], regarding IoT NTN Cat-M1 UE reference sensitivity difference between FDD and HD-FDD duplex modes, HD-FDD REFSENS is 0.8dB better than FDD REFSENS. The lower HD-FDD RF front-end insertion loss compared to FDD insertion loss contributes the HD-FDD REFSENS improvement.*** Table 7.3A-1: Reference sensitivity for FDD UE category M1 QPSK PREFSENS

|  |  |  |
| --- | --- | --- |
| NTN Band | REFSENS (dBm) | Duplex Mode |
| 253 | -102.7 | FDD |
| 254 | -102.2 | FDD |
| 255 | -102.7 | FDD |
| 256 | -102.2 | FDD |

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 |
| 254 | -103.1 | HD-FDD |
| 255 | -103.5 | HD-FDD |
| 256 | -103 | HD-FDD |

***Observation 3: The HD-FDD RF front-end (FE) insertion loss is lower compared to FD-FDD FE insertion loss, which could improve ~0.8dB the HD-FDD UE RX REFSENS and TX maximum output power simultaneously.******Observation 4: For IoT-NTN Cat-M1 UE, it can be observed that TX maximum output power increases when switching FD-FDD mode to HD-FDD mode. The Tx output power improvement could be 0.4dB.*** ***Proposal 5:*** ***Regarding IoT-NTN UE which supports both HD-FDD and FD-FDD duplex modes for the IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), consider whether PC3 maximum output power would be feasible as:******Option 1: PC3 of [23.4] dBm.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4] | +/-2 |

***Option 2: PC3 of 23 dBm with +[2.4]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | 23 | +[2.4]/-2 |

***Option 3: PC3 of [23.2] dBm with +[2.2]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.2] | +[2.2]/-2 |

***Proposal 6: Regarding IoT-NTN UE which only supports HD-FDD duplex mode for the IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), consider whether PC3 maximum output power would be feasible as:******Option 1: PC3 of [23.4~23.8] dBm.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4~23.8] | +/-2 |

***Option 2: PC3 of 23 dBm with +[2.8]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | 23 | +[2.8]/-2 |

***Option 3: PC3 of [23.4] dBm with +[2.4]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4] | +[2.4]/-2 |

 |
| [**R4-2411845**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411845.zip) | ZTE Corporation, Sanechips | **Proposal 1: Operating band and band numbering for the new IoT-NTN FDD band can be defined as Table 2.1-1, and it supports UE categories NB1, NB2, M1.**  Table 2.1-1: E-UTRA operating bands for satellite access

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| [252] | 2000 MHz | – | 2020 MHz | 2180 MHz | – | 2200 MHz | FDD |

**Proposal 2: EARFCN for category M1 for IoT-NTN band [252] can be defined as Table 2.2-1.**Table 2.2-1: E-UTRA channel numbers

|  |  |  |  |
| --- | --- | --- | --- |
| E-UTRA OperatingBand | 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) |
| [252] | 100 | 2180 | 228301 | 228301 –<1>- 228500 | 2000 | 261069 | 261069 –<1>- 261268 |

**Proposal 3: The default TX-RX frequency separation for IoT-NTN band [252] should be defined as Table 2.3-1.**Table 2.3-1: Default UE TX-RX frequency separation

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [252] | 180 MHz |

**Proposal 4: To use the proposals in Table 2.4-1 for UE RF requirements for the new IoT-NTN S-band.****Table 2.4-1 UE RF requirements for the new IoT-NTN S-band**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new new IoT-NTN S-band** |
| 6.2A.1 UE maximum output power for category M1 | Band specific --> Specification impact. Support UE Power Class 3 (+23dBm) and Power Class 5 (+20dBm). |
| 6.2B.1 UE maximum output power for category NB1 and NB2 |
| 6.2A.2 UE maximum output power reduction for category M1 | Not band specific --> No specification impact. |
| 6.2B.2 UE maximum output power reduction for category NB1 and NB2 |
| 6.2A.3 A-MPR for category M1 UE | Band specific --> Specification impact. A-MPR requirement for B23 can be reused for the new IoT-NTN S-band. |
| 6.2B.3 A-MPR for category NB1 and NB2 UE |
| 6.2A.4 Configured transmitted Power for category M1 | Not band specific --> No specification impact. |
| 6.2B.4 Configured transmitted Power for category NB1 and NB2 |
| 6.3A Output power dynamics for category M1 | No specification impact. |
| 6.3B Output power dynamics for category NB1 and NB2 |
| 6.4A Transmit signal quality for category M1 | Not band specific --> No specification impact. |
| 6.4B Transmit signal quality for category NB1 and NB2 |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5A.2 Occupied bandwidth for category M1 | Not band specific --> No specification impact. |
| 6.5B.2 Occupied bandwidth for category NB1 and NB2 |
| 6.5A.3.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5B.3.2 Spectrum emission mask |
| 6.5A.3.3 Additional Spectrum Emission Mask for category M1 | Not applicable. |
| 6.5B.3.3 Additional Spectrum Emission Mask for category NB1 and NB2 |
| 6.5A.3.4 Adjacent Channel Leakage Ratio for category M1 | Not band specific --> No specification impact. |
| 6.5B.3.4 Adjacent Channel Leakage Ratio for category NB1 and NB2 |
| 6.5A.4.2 General spurious emissions | Not band specific --> No specification impact. |
| 6.5B.4.2 General spurious emissions |
| 6.5A.4.3 Spurious emission band UE co-existence | Specification impact. Band [252] needs to be added in Table 6.5A.4.3-1. |
| 6.5B.4.3 Spurious emission band UE co-existence |
| 6.5A.4.4 Additional spurious emissions | Specification impact.Additional spurious emissions requirement for B23 can be reused for the new IoT-NTN S-band. |
| 6.5B.4.4 Additional spurious emissions |
| 6.6A Transmit intermodulation for category M1 | Not applicable. |
| 6.6B Transmit intermodulation for category NB1 and NB2 | No specification impact. |
| 7.3A Reference sensitivity power level for UE category M1 | Band specific --> Specification impact.  |
| 7.3B Reference sensitivity power level for UE category NB1 and NB2 | Band specific.REFSENS requirement for B23 can be reused for the new IoT-NTN S-band. |
| 7.4A Maximum input level for category M1 | Not band specific --> No specification impact. |
| 7.4B Maximum input level for category NB1 and NB2 |
| 7.5A Adjacent Channel Selectivity for category M1 | Not band specific --> No specification impact. |
| 7.5B Adjacent Channel Selectivity for category NB1 and NB2 |
| 7.6A.2 In-band blocking requirements for category M1 | Specification impact --> Considering define in-band blocking requirement similar to band 253, 254, 255, 256. |
| 7.6B.2 In-band blocking requirements for category NB1 and NB2 | No specification impact. |
| 7.6A.3 Out-of-band blocking requirements for category M1 | Specification impact --> Considering define out-of-band blocking requirement similar to band 253, 254, 255. |
| 7.6B.3 Out-of-band blocking requirements for category NB1 and NB2 |
| 7.6A.4 Narrow band blocking for category M1 | No specification impact. |
| 7.6B.4 Narrow band blocking for category NB1 and NB2 | Not applicable. |
| 7.7A Spurious response for category M1 | Not band specific --> No specification impact. |
| 7.7B Spurious response for category NB1 and NB2 |
| 7.8A Intermodulation characteristics for category M1 | Not band specific --> No specification impact. |
| 7.8B Intermodulation characteristics for category NB1 and NB2 |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

 |
| [**R4-2411846**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411846.zip) | ZTE Corporation, Sanechips | **Proposal 1: To use the proposals in Table 1 for SAN RF requirements for the new IoT-NTN FDD band.****Table 1: SAN RF requirements for the new IoT-NTN FDD band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new IoT-NTN FDD band** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar as other bands. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN. |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |
| 7.8 In-channel selectivity | Not band specific --> No specification impact. |

 |
| [**R4-2411847**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411847.zip) | ZTE Corporation, Sanechips | **Title:** draftCR to TS36.108 Introduction of IoT-NTN S band**Type:** Draft CR (Cat. B)**Target Spec:** TS 36.108**Reason:** Introduction of IoT-NTN S band.**Summary of change:**Relevant sections for IoT-NTN S band are updated.* 5.2, 5.4A.2
 |
| [**R4-2412460**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412460.zip) | Mediatek India Technology Pvt. | ***Observation 1: Regarding the conventional isolation distance of 2m between UE-UE coexistence operation, the free space path loss between UEs is 44.5dB for 2GHz band. Thus, it seems reasonable to define the general spurious-emission requirement of -50dBm/MHz for UE-coexistence.*** ***Observation 2: Regarding the isolation distance of 1500m between NTN and TN operation, the free space path loss from NTN-UE TX to TN-UE RX is 102dB for 2GHz band.*** ***Proposal 1: Discuss whether the general spurious-emission requirement of -50dBm/MHz for UE coexistence would be conditionally relaxed for NTN-TN coexistence due to higher isolation distance.*** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: Work Plan

*Sub-topic description:*

*Open issues and candidate options before meeting:*

#### Issue 2-1-1: Proposed Work Plan

* Proposals
	+ Option 1: Agree the proposed workplan for an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) spectrum WI for North America (Mediatek)

|  |
| --- |
| 2.1 RF Core-Part and SAN Conformance-Testing requirements**1) RAN4#112 (August 2024)**- General aspects.* Agreements on work plan

- Identification of the regulatory, UE coexistence, and RF-core requirements that need discussions.- To study whether some initial system parameters and RF requirements could be inherited from the existing IoT NTN and/or terrestrial IoT bands.* Agreements on some initial system parameters and RF requirements if applicable

**2) RAN4#112bis (October 2024)**- Further discussions on * The regulatory requirements if necessary
* The UE coexistence requirements
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)

- If applicable, make agreements on regulatory and co-existence requirements.- If applicable, make agreements on further system parameters and RF requirements (e.g., REFSENS).**3) RAN4#113 (November 2024)**- Further discussions on * The regulatory and UE coexistence requirements if necessary
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)

- Discussions on * SAN conformance-testing requirements (perf part)

- Aiming at regulatory-requirements finalisation especially for TR 36.764- Aiming at RF-core requirements finalisation.- If applicable, make initial agreements on SAN conformance-testing requirements.- Endorse the draft CRs for the RF-core specifications especially for UE RF (e.g., TS 36.102, TR 36.764). **4) RAN4#114 (February 2025)**- Further discussions on * The regulatory and UE coexistence requirements if necessary
* SAN and UE RF requirements (e.g., REFSENS, A-MPR)
* SAN conformance-testing requirements (perf part)

- Finalisation of the remaining RF-core requirements.- Agree SAN conformance-testing requirements.- Endorse the draft CRs for the rest core specifications.**5) RAN4#114bis (April 2025)**- Finalisation of the remaining issues if any. - Endorse the draft CRs for the remaining issues if any.**6) RAN4#115 (May 2025)**- Finalisation of the remaining issues if any. - Agree all the CRs.2.2 RRM Performance-Part requirements**1) RAN4#114bis (April 2025)**- Discussion on RRM performance requirements and test cases.- Aiming at RRM performance requirements and test cases finalization.- Agree the draft CRs for TS 36.133 if any.**2) RAN4#115 (May 2025)**- Finalisation of RRM performance requirements and test cases. - Agree all the CRs if any.2.3 UE and SAN Demodulation Performance-Part requirements **1) RAN4#114bis (April 2025)**- Discussion on UE and SAN demodulation requirements.* + If necessary, update the UE and SAN demodulation requirements.

- Aiming at finalization of UE and SAN demodulation requirements.- Agree the draft CR if any.**2) RAN4#115 (May 2025)**- Finalization of UE and SAN demodulation requirements.- Agree all the CRs if any.  |

* + Option 2: Other
* Recommended WF
	+ Agree to the proposed Work Plan

### Sub-topic 2-2: General Aspects

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 2-2-1: Band Numbering

* **Proposals**
	+ Option 1: Band 252 (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint, Mediatek, )
	+ Option 2: Other
* **Recommended WF**
	+ Adopt 252 as the band number for the new IoT NTN S-band.

#### Issue 2-2-2: Band Plan

* **Proposals**
	+ Option 1: Adopt the proposed band plan as follows (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint , Mediatek, ZTE Corporation, Sanechips)

E-UTRA operating bands for satellite access

|  |  |  |  |
| --- | --- | --- | --- |
| E‑UTRA Operating Band | Uplink (UL) operating bandBS receiveUE transmit | Downlink (DL) operating bandBS transmit UE receive | Duplex Mode |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| 256 | 1980 MHz | – | 2010 MHz | 2170 MHz | – | 2200 MHz | FDD |
| 255 | 1626.5 MHz | – | 1660.5 MHz | 1525 MHz | – | 1559 MHz | FDD |
| 254 | 1610 MHz | - | 1626.5 MHz | 2483.5 MHz | - | 2500 MHz | FDD |
| 2532 | 1668 MHz | - | 1675 MHz | 1518 MHz | - | 1525 MHz | FDD |
| 252 | 2000 MHz | - | 2020 MHz | 2180 MHz | - | 2200 MHz | FDD |
| NOTE 1: Satellite bands are numbered in descending order from 256NOTE 2: UE assigned to channels and allocated frequency resources in the lower portion of Band 253 may experience blocking or harmful interference from terrestrial networks in adjacent or nearby frequencies when operating in the proximity with terrestrial base stations. |

* + Option 2: Other
* **Recommended WF**
	+ Agree to Option 1 as a starting point.

#### Issue 2-2-3: Regulatory Background

* **Proposals**
	+ Proposal 1: It is proposed to capture the listed FCC CFR applicable for this band in the TR 38.863 (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Proposal 2: ATC is not applicable, hence out of scope for this work (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Proposal 3: Other
* **Recommended WF**
	+ Consider if Proposal 1 and Proposal 2 can be agreed as a starting point.
	+ Applicable regulations can be further discussed after the applicable regions and countries for this band have been agreed.

#### Issue 2-2-4: General Coexistence Aspects

* **Proposals**
	+ Option 1: The same deployment scenario as listed in TR 38.863, and used for other NTN bands, be used for the new NTN S-band (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Option 2: Other
* **Recommended WF**
	+ Consider reusing the deployment assumptions in TR 38.863 as a starting point for the new IoT NTN S-band.

#### Issue 2-2-5: UE-to-UE Coexistence

* **Proposals**
	+ Option 1: (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint)
		- RAN4 should re-evaluate the requirements of -50 dBm/MHz for TN - NTN UE co-existence using realistic deployment scenarios and UE parameters.
			* TR 38.863 [5] refers to a separation distance of 1500 m between TN and NTN UEs. The UE-UE co-existence value of -50 dBm/MHz is based on a separation distance of 1m [4].
	+ Option 2: Other
* **Recommended WF**
	+ Consider reusing the deployment assumptions from TR 38.863 as a starting point for the new IoT NTN S-band and further discuss the requirements for UE-to-UE coexistence.

#### Issue 2-2-6: Bands in Scope for TN-NTN Coexistence

* **Proposals**
	+ Option 1: As concluded in [5] and agreed to for n256 UL and n2/n25 DL in [6], coexistence for overlapping band between the proposed NTN S-band [n252/B252] and TN bands n70 and n66 downlinks DL be out of scope of this work. (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint)
	+ Option 2: Other
* **Recommended WF**
	+ Consider the coexistence between overlapping bands as out-of-scope for this work.

### Sub-topic 2-3: System Parameters and UE RF

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 2-3-1: Channel Bandwidths

* **Proposals**
	+ Option 1: Regarding CBW, the addition of an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) does not have any impact on the CBW sub-clauses for category M1 or category NB1/NB2
	+ Option 2: Other
* **Recommended WF**
	+ .

#### Issue 2-3-2: EARFCN for CAT M1

* **Proposals**
	+ Option 1: EARFCN for category M1 for IoT-NTN band [252] can be defined as Table 2.2-1. (ZTE Corporation, Sanechips)

Table 2.2-1: E-UTRA channel numbers

|  |  |  |  |
| --- | --- | --- | --- |
| E-UTRA OperatingBand | 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) |
| [252] | 100 | 2180 | 228301 | 228301 –<1>- 228500 | 2000 | 261069 | 261069 –<1>- 261268 |

* + Option 2: Other
* **Recommended WF**
	+ TBA

#### Issue 2-3-3: Default TX-RX Separation

* **Proposals**
	+ Option 1: As for an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), to set the default Tx-Rx frequency separation as fixed value first. Further study variable Tx-Rx frequency separation (Mediatek)
	+ Option 2: The default TX-RX frequency separation for IoT-NTN band [252] should be defined as Table 2.3-1 (ZTE Corporation, Sanechips)

Table 2.3-1: Default UE TX-RX frequency separation

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [252] | 180 MHz |

* + Option 3: Other
* **Recommended WF**
	+ TBA

#### Issue 2-3-4: General Views on Impact to UE RF Requirements

* **Proposals**
	+ Option 1: To agree the proposals in the Table 2.3-1 if there is no specific concern, or at least use them as the starting point for further discussions on an IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL) UE TX and RX RF requirements

|  |  |  |  |
| --- | --- | --- | --- |
| **Requirement name** | **Band-agnostic?** | **Reuse 36.102 requirement?** | **Comments** |
| Clause 6: Transmitter Characteristics |  |  |  |
| 6.2A.1/6.2B.1:UE maximum output power | Yes | See comments | Discussion on Proposal 5.  |
| 6.2A.1/6.2B.1:UE maximum output power tolerance | See comments | See comments | Discussion on Proposal 5. |
| 6.2A.2/6.2B.2:UE maximum output power reduction | Yes | Yes | Different MPR tables for category M1 and NB1/NB2 separately.  |
| 6.2A.3/6.2B.3:UE additional maximum output power reduction | No | See comments | Need further discussion based on UE-UE coexistence analysis |
| 6.3: Output power dynamics | Yes | Yes |  |
| 6.4: Transmit signal quality | Yes | Yes |  |
| 6.5A.3.2/6.5B.3.2:Spectrum emission mask | Yes | Yes |  |
| 6.5A.3.4/6.5B.3.4:Adjacent Channel Leakage Ratio | Yes | Yes |  |
| 6.5A.4.3/6.5B.4.3:Spurious emissions for UE co-existence | No |  |  |
| 6.5A.4.4/6.5B.4.4:Additional spurious emissions | No |  |  |
| 6.6: Transmit intermodulation for category NB1 and NB2 | Yes | Yes |  |
| 7: Receiver characteristics |  |  |  |
| 7.2: Diversity characteristics | Yes | Yes |  |
| 7.3: Reference sensitivity power level | No | See comments | Because the new band’s 2180-2200 MHz DL frequency range is overlapping with band 256 DL, to consider putting band 256 REFSENS into square bracket as starting point for the new band.  |
| 7.4: Maximum input level | Yes | Yes |  |
| 7.5: Adjacent Channel Selectivity | Yes | Yes |  |
| 7.6A.2/7.6B.2:In-band blocking | No | Yes if there is no specific concern | Different band group may have different In-band blocking tables for Cat-M1 and NB1/NB2 separately. Currently, bands 256,255,254, and 253 apply the same IBB requirements.  |
| 7.6A.3/7.6B.3:Out-of-band blocking | No | See comments | Different Out-of-band requirements for IoT NTN bands; whether to leverage requirement from band 256 needs further discussion.  |
| 7.6A.4/7.6B.4:Narrow band blocking | No | Yes if there is no specific concern |  |
| 7.7: Spurious response | Yes | Yes |  |
| 7.8: Intermodulation characteristics | Yes | Yes |  |
| 7.9: RX spurious emission | No | Yes if there is no specific concern |  |

* + Option 2: To use the proposals in Table 2.4-1 for UE RF requirements for the new IoT-NTN S-band (ZTE Corporation, Sanechips)

**Table 2.4-1 UE RF requirements for the new IoT-NTN S-band**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new new IoT-NTN S-band** |
| 6.2A.1 UE maximum output power for category M1 | Band specific --> Specification impact. Support UE Power Class 3 (+23dBm) and Power Class 5 (+20dBm). |
| 6.2B.1 UE maximum output power for category NB1 and NB2 |
| 6.2A.2 UE maximum output power reduction for category M1 | Not band specific --> No specification impact. |
| 6.2B.2 UE maximum output power reduction for category NB1 and NB2 |
| 6.2A.3 A-MPR for category M1 UE | Band specific --> Specification impact. A-MPR requirement for B23 can be reused for the new IoT-NTN S-band. |
| 6.2B.3 A-MPR for category NB1 and NB2 UE |
| 6.2A.4 Configured transmitted Power for category M1 | Not band specific --> No specification impact. |
| 6.2B.4 Configured transmitted Power for category NB1 and NB2 |
| 6.3A Output power dynamics for category M1 | No specification impact. |
| 6.3B Output power dynamics for category NB1 and NB2 |
| 6.4A Transmit signal quality for category M1 | Not band specific --> No specification impact. |
| 6.4B Transmit signal quality for category NB1 and NB2 |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5A.2 Occupied bandwidth for category M1 | Not band specific --> No specification impact. |
| 6.5B.2 Occupied bandwidth for category NB1 and NB2 |
| 6.5A.3.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5B.3.2 Spectrum emission mask |
| 6.5A.3.3 Additional Spectrum Emission Mask for category M1 | Not applicable. |
| 6.5B.3.3 Additional Spectrum Emission Mask for category NB1 and NB2 |
| 6.5A.3.4 Adjacent Channel Leakage Ratio for category M1 | Not band specific --> No specification impact. |
| 6.5B.3.4 Adjacent Channel Leakage Ratio for category NB1 and NB2 |
| 6.5A.4.2 General spurious emissions | Not band specific --> No specification impact. |
| 6.5B.4.2 General spurious emissions |
| 6.5A.4.3 Spurious emission band UE co-existence | Specification impact. Band [252] needs to be added in Table 6.5A.4.3-1. |
| 6.5B.4.3 Spurious emission band UE co-existence |
| 6.5A.4.4 Additional spurious emissions | Specification impact.Additional spurious emissions requirement for B23 can be reused for the new IoT-NTN S-band. |
| 6.5B.4.4 Additional spurious emissions |
| 6.6A Transmit intermodulation for category M1 | Not applicable. |
| 6.6B Transmit intermodulation for category NB1 and NB2 | No specification impact. |
| 7.3A Reference sensitivity power level for UE category M1 | Band specific --> Specification impact.  |
| 7.3B Reference sensitivity power level for UE category NB1 and NB2 | Band specific.REFSENS requirement for B23 can be reused for the new IoT-NTN S-band. |
| 7.4A Maximum input level for category M1 | Not band specific --> No specification impact. |
| 7.4B Maximum input level for category NB1 and NB2 |
| 7.5A Adjacent Channel Selectivity for category M1 | Not band specific --> No specification impact. |
| 7.5B Adjacent Channel Selectivity for category NB1 and NB2 |
| 7.6A.2 In-band blocking requirements for category M1 | Specification impact --> Considering define in-band blocking requirement similar to band 253, 254, 255, 256. |
| 7.6B.2 In-band blocking requirements for category NB1 and NB2 | No specification impact. |
| 7.6A.3 Out-of-band blocking requirements for category M1 | Specification impact --> Considering define out-of-band blocking requirement similar to band 253, 254, 255. |
| 7.6B.3 Out-of-band blocking requirements for category NB1 and NB2 |
| 7.6A.4 Narrow band blocking for category M1 | No specification impact. |
| 7.6B.4 Narrow band blocking for category NB1 and NB2 | Not applicable. |
| 7.7A Spurious response for category M1 | Not band specific --> No specification impact. |
| 7.7B Spurious response for category NB1 and NB2 |
| 7.8A Intermodulation characteristics for category M1 | Not band specific --> No specification impact. |
| 7.8B Intermodulation characteristics for category NB1 and NB2 |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

* + Option 3: Other
* **Recommended WF**
	+ Further discuss impact on RF requirements.
	+ Consider whether some requirements from Bands 256, 255, 254, 253 can be reused.
	+ Consider whether some requirements from Band 23 can be reused.

#### Issue 2-3-5: UE REFSENS

* **Proposals**
	+ Option 1: In TS 36.102 [2], regarding IoT NTN Cat-M1 UE reference sensitivity difference between FDD and HD-FDD duplex modes, HD-FDD REFSENS is 0.8dB better than FDD REFSENS. The lower HD-FDD RF front-end insertion loss compared to FDD insertion loss contributes the HD-FDD REFSENS improvement. (Mediatek)

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

|  |  |  |
| --- | --- | --- |
| NTN Band | REFSENS (dBm) | Duplex Mode |
| 253 | -102.7 | FDD |
| 254 | -102.2 | FDD |
| 255 | -102.7 | FDD |
| 256 | -102.2 | FDD |

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 |
| 254 | -103.1 | HD-FDD |
| 255 | -103.5 | HD-FDD |
| 256 | -103 | HD-FDD |

* + Option 2: REFSENS requirement for B23 can be reused for the new IoT-NTN S-band.
	+ Option 3: Other
* **Recommended WF**
	+ TBA

#### Issue 2-3-6: UE Power Class and Maximum Output Power – UE Supporting both HD-FDD and FD-FDD (i.e. Cat M1)

* **Proposals**
	+ Regarding IoT-NTN UE which supports both HD-FDD and FD-FDD duplex modes for the IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), consider whether PC3 maximum output power would be feasible as (Mediatek):
	+ ***Option 1: PC3 of [23.4] dBm.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4] | +/-2 |

* + ***Option 2: PC3 of 23 dBm with +[2.4]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | 23 | +[2.4]/-2 |

* + ***Option 3: PC3 of [23.2] dBm with +[2.2]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.2] | +[2.2]/-2 |

* + Option 4: Support UE Power Class 3 (+23dBm) and Power Class 5 (+20dBm) (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint, ZTE Corporation, Sanechips)
	+ Option 5: Other
* **Recommended WF**
	+ TBA

#### Issue 2-3-7: UE Power Class and Maximum Output Power – UE Supporting HD-FDD only (i.e. Cat M1 and Cat NB1, NB2)

* **Proposals**
	+ Regarding IoT-NTN UE which only supports HD-FDD duplex mode for the IoT-NTN S-band (MSS band 2000-2020 MHz UL and 2180-2200 MHz DL), consider whether PC3 maximum output power would be feasible as (Mediatek):
	+ ***Option 1: PC3 of [23.4~23.8] dBm.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4~23.8] | +/-2 |

* + ***Option 2: PC3 of 23 dBm with +[2.8]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | 23 | +[2.8]/-2 |

* + ***Option 3: PC3 of [23.4] dBm with +[2.4]/-2 dB power tolerance.***

|  |  |  |
| --- | --- | --- |
| EUTRA band | Class 3 (dBm) | Tolerance (dB) |
| [252] | [23.4] | +[2.4]/-2 |

* + Option 4: Support UE Power Class 3 (+23dBm) and Power Class 5 (+20dBm) (EchoStar, DISH Network, TerreStar, Thales, Gatehouse, Novamint, ZTE Corporation, Sanechips)
	+ Option 5: Other
* **Recommended WF**
	+ TBA

### Sub-topic 2-4: SAN RF

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 2-4-1: SAN EARFCN

* **Proposals**
	+ Option 1: draftCR to TS36.108 Introduction of IoT-NTN S band (ZTE Corporation, Sanechips)

Table 5.4A.2-1: E-UTRA channel numbers

|  |  |  |  |
| --- | --- | --- | --- |
| E-UTRA OperatingBand | 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) |
| 256 | 100 | 2170 | 229076 | 229076 –<1>- 229375 | 1980 | 261844 | 261844 –<1>- 262143 |
| 255 | 100 | 1525 | 228736 | 228736 –<1>- 229075 | 1626.5 | 261504 | 261504 –<1>- 261843 |
| 254 | 100 | 2483.5 | 228571 | 228571 –<1>- 228735 | 1610 | 261339 | 261339 –<1>- 261503 |
| 253 | 100 | 1518 | 228501 | 228501 –<1>- 228570 | 1668 | 261269 | 261269 –<1>- 261338 |
| [252] | 100 | 2180 | 228301 | 228301 –<1>- 228500 | 2000 | 261069 | 261069 –<1>- 261268 |
| NOTE: 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. |

* + Option 2: TBA
* **Recommended WF**
	+ TBA

#### Issue 2-4-2: SAN TX

* **Proposals**
	+ Option 1: To use the proposals in Table 1 for SAN RF requirements for the new IoT-NTN FDD band (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new IoT-NTN FDD band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new IoT-NTN FDD band** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar as other bands. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN. |

* + Option 2: TBA
* **Recommended WF**
	+ TBA

#### Issue 2-4-3: SAN RX

* **Proposals**
	+ Option 1: To use the proposals in Table 1 for SAN RF requirements for the new IoT-NTN FDD band (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new IoT-NTN FDD band**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new IoT-NTN FDD band** |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |
| 7.8 In-channel selectivity | Not band specific --> No specification impact. |

* + Option 2: Other
* **Recommended WF**
	+ TBA

# Topic #3: NR\_NTN\_combinedLband

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411263**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411263.zip) | Apple | Table 2-2: Exemplary band plan for the combined L-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Acronym | NTN band | DL block (MHz) | UL block (MHz) | Size (MHz) |
| Combined L-band | xx1 | 1518-1559 | 1626.5-1660.5 | 41 (DL) / 34 (UL) |
| xx2 | 1518-1559 | 1668-1675 | 41 (DL) / 7 (UL) |

Proposal: To support the combined L-band, introduce two NTN bands with the common DL block (at 1518-1559) and two UL blocks (at 1626.5-1660.5 and 1668-1675). |
| [**R4-2411550**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411550.zip) | Inmarsat, Viasat | **Proposal 1: Specify two new NR NTN bands, with band number n251 for n255 UL and n255+n253 (specified for NB-IoT – to be specified for NR) DL and band number n250 for n253 UL and 255+n253DL.**Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 – 1626.5 MHz | 2483.5 – 2500 MHz | FDD |
| n253 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| n252 | Reserved for S-band | FDD |
| n251 | 1626.5MHz – 1660.5MHz | 1518MHz – 1559MHz | FDD |
| n250 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

**Proposal 2: General requirements do not need to be changed. Areas of concern are spectrum /coexistence related specification e.g. Spurious emissions, and some Rx requirements, REFSENS due to self interference and out of band blocking.**Table 3: Required changes compare to current spec TS 38.101-5 [3] (Note: applicable to respective sections of TS 36.102)

|  |  |  |
| --- | --- | --- |
| Section | Requirement | Proposal for NR-NTN (Note: applicable also for IoT-NTN in respective sections of TS36.102) |
| **Tx requirements** |
| 6.2.1 | UE maximum output power | As proposed in the WID [1]PC3 for NR-NTN |
| 6.2.2 | UE maximum output power reduction | No changes  |
| 6.2.3 | UE additional maximum output power reduction | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.2.4 | Configured transmitted power | No changes |
| 6.3.1 | Minimum output power | No changes |
| 6.3.2 | Transmit OFF power | No changes |
| 6.3.3 | Transmit ON/OFF time mask | No changes |
| 6.3.4 | Power control | No changes |
| 6.4 | Transmit signal quality | No changes |
| 6.5.1 | Occupied bandwidth | No changes |
| 6.5.2 | Out of band emission (ACLR) | No changes |
| 6.5.3.1 | General Spurious emissions | No changes |
| 6.5.3.2 | Spurious emissions for UE co-existence | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.3.3 | Additional spurious emissions | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.4 | Transmit intermodulation | No changes |
| **Rx requirements** |
| 7.3 | Reference sensitivity | FFS (tied to Tx-Rx separation discussion) |
| 7.4 | Maximum input level | No changes |
| 7.5 | Adjacent channel selectivity | No changes |
| 7.6.1 | General | No changes |
| 7.6.2 | In-band blocking | No changes |
| 7.6.3 | Out-of-band blocking | FFS (due to sub-n253 blocking requirement) |
| 7.6.4 | Narrow band blocking | Borrowed from n255 |
| 7.7 | Spurious response | No changes |
| 7.8 | Intermodulation characteristics | No changes |

**Proposal 3: ETSI EN 301 681 shall be used to assess the regulatory compliance of this new band, and shall be used to inform decisions on spectrum emissions related requirements such as A-MPR.****Proposal 4: FCC Part 25 clause 202 shall be used to assess the regulatory compliance of this new band, and shall be used to inform decisions on spectrum emissions related requirements such as A-MPR.****Observation 1: ECC Report 263 considers MSS systems as victims to TN systems deployed directly adjacent to n253 downlink lower edge and has offered mitigation strategies.****Proposal 5: The scope of the study carried out in TR 38.863 shall also be true for this band definition when concerned with UE-UE coexistence.****Proposal 6: Only n253 NR coexistence with n253 NTN UE as victim needs to be considered for the definition of these bands, and only for bands n74, n84, n92, n75 and n50.** |
| [**R4-2411848**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411848.zip) | ZTE Corporation, Sanechips | **Proposal 1: Operating band and band numbering for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz) can be defined as Table 2.1-1.** EXTENDED L BAND**Figure 2.1-1: Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz)**Table 2.1-1: NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n251] | 1668 MHz - 1675 MHz | 1518 MHz - 1525 MHz | FDD |
| [n250] | 1626.5 MHz - 1660.5 MHz | 1518 MHz - 1559 MHz | FDD |
| [n249] | 1668 MHz - 1675 MHz | 1518 MHz - 1559 MHz | FDD |

**Proposal 2: Firstly, supported channel bandwidths and SCS can be defined as Table 2.2-1. Whether to support 25, 35, 40 MHz channel bandwidth needs further study.**Table 2.2-1: Channel bandwidths for each NTN satellite band in FR1-NTN

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | 30(NOTE) |
|  | 15 | 5 |  |  |  |  |
| [n251] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n250] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
|  | 15 | 5 |  |  |  |  |
| [n249] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |

**Proposal 3: New NTN bands [n250] and [n249] can support asymmetric channel bandwidths.****Proposal 4: NR-ARFCN for the new NR-NTN bands supporting 100 kHz and 10 kHz channel raster can be defined as Table 2.4-1 and Table 2.4-2, respectively.**Table 2.4-1: Applicable NR-ARFCN per operating band in FR1-NTN with 100 kHz channel rater

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n251] | 100 | 333600– <20> – 335000 | 303600 – <20> – 305000 |
| [n250] | 100 | 325300– <20> – 332100 | 303600 – <20> – 311800 |
| [n249] | 100 | 333600– <20> – 335000 | 303600 – <20> – 311800 |

Table 2.4-2: Applicable NR-ARFCN per operating band in FR1-NTN with 10 kHz channel rater

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| [n251] | 10 | 333600– <2> – 335000 | 303600 – <2> – 305000 | Yes |
| [n250] | 10 | 325300– <2> – 332100 | 303600 – <2> – 311800 | Yes |
| [n249] | 10 | 333600– <2> – 335000 | 303600 – <2> – 311800 | Yes |

**Proposal 5: We propose that band [n251] and [n249] support case A SSB pattern, and band [n250] supports case A and case B SSB pattern. Sync raster and GSCN for the these bands can be defined as Table 2.4-3.**Table 2.4-3: Applicable SS raster entries per operating band (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | SS Block SCS | SS Block pattern1 | Range of GSCN(First – <Step size> – Last) |
| [n251] | 15 kHz | Case A | 3800 – <1> – 3807 |
| [n250] | 15 kHz | Case A | 3800 – <1> – 3892 |
|  | 30 kHz | Case B | 3806 – <1> – 3886 |
| [n249] | 15 kHz | Case A | 3800 – <1> – 3892 |

**Proposal 6: The flexible TX-RX frequency separation for for the new NR-NTN bands should be defined as Table 2.5-1.**Table 2.5-1: UE TX-RX frequency separation (FR1-NTN)

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [n251] | 148 – 152 MHz |
| [n250] | 72.5 – 137.5 MHz |
| [n249] | 114 – 152 MHz |

**Proposal 7: To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN bands.****Table 2.6-1 UE RF requirements for the new NR-NTN bands**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new NR-NTN bands** |
| 6.2.1 UE maximum output power | Band specific --> Specification impact. Support UE Power class 3 (+23dBm). |
| 6.2.2 MPR | Not band specific --> No specification impact. |
| 6.2.3 A-MPR | Band specific --> Specification impact. A-MPR requirement needs further study. |
| 6.2.4Configured transmitted power | Not band specific --> No specification impact. |
| 6.3.1 Minimum output power | Not band specific --> No specification impact. |
| 6.3.2 Transmit OFF power | Not band specific --> No specification impact. |
| 6.3.3 Transmit ON/OFF time mask | Not band specific --> No specification impact. |
| 6.3.4 Power control | Not band specific --> No specification impact. |
| 6.4.1 Frequency error | Not band specific --> No specification impact. |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5.1 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.5.2.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5.2.3 Additional Spectrum emission mask | Specification impact.Requirements for protection of the Radio Astronomy in the 1660-1670 MHz range shall be captured. |
| 6.5.2.4.1 NR ACLR | Not band specific --> No specification impact. |
| 6.5.2.4.2 UTRA ACLR | Not band specific --> No specification impact. |
| 6.5.3.1 General spurious emissions | Not band specific --> No specification impact. |
| 6.5.3.2 Spurious emissions for UE co-existence | Specification impact. Bands [n251], [n250] and [n249] need to be added in Table 6.5.3.2-1. |
| 6.5.3.3 Additional spurious emissions | Specification impact.Requirements for protection of the Radio Astronomy in the 1660-1670 MHz range shall be captured. |
| 6.5.4 Transmit intermodulation | Not band specific --> No specification impact. |
| 7.3.2 Reference sensitivity  | Band specific --> Specification impact. REFSENS requirement needs to be defined for bands [n251], [n250] and [n249]. |
| 7.4 Max input level | Not band specific --> No specification impact. |
| 7.5 Adjacent channel selectivity | Not band specific --> No specification impact. |
| 7.6.2 In-band blocking | Specification impact --> Define in-band blocking requirement similar to band n254, n255, n256. |
| 7.6.3 Out of band blocking  | Specification impact --> Out-of-band blocking requirement needs to be defined for bands [n251], [n250] and [n249]. |
| 7.6.4 Narrow band blocking | Specification impact --> Define narrow band blocking requirement similar to band n254, n255, n256. |
| 7.7 Spurious response | Not band specific --> No specification impact. |
| 7.8 Intermodulation characteristics | Not band specific --> No specification impact. |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

 |
| [**R4-2411849**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411849.zip) | ZTE Corporation, Sanechips | **Proposal 1: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz).****Table 1: SAN RF requirements for the new NR-NTN bands**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN bands** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN --> No specification impact. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar to band n254, n255, n256. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN --> No specification impact. |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN --> No specification impact. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN --> No specification impact. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |
| 7.8 In-channel selectivity | Not band specific --> No specification impact. |

 |
| [**R4-2411850**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411850.zip) | ZTE Corporation, Sanechips | **Title:** draftCR to TS38.108 Introduction of NR-NTN combined L-band**Type:** Draft CR (Cat. B)**Target Spec:** TS 38.108**Reason:** Introduction of NR-NTN combined L-band.**Summary of change:**Relevant sections for NR-NTN combined L-band are updated.* 5.2, 5.3.5, 5.4.2.3, 5.4.3.3

Table 5.2-1: Satellite *operating bands* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite *operating band* | Uplink (UL) *operating band*SAN receive / UE transmitFUL,low – FUL,high | Downlink (DL) *operating band*SAN transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 MHz – 1626.5 MHz  | 2483.5 MHz – 2500 MHz | FDD |
| [n251] | 1668 MHz - 1675 MHz | 1518 MHz - 1525 MHz | FDD |
| [n250] | 1626.5 MHz - 1660.5 MHz | 1518 MHz - 1559 MHz | FDD |
| [n249] | 1668 MHz - 1675 MHz | 1518 MHz - 1559 MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from n256. |

Table 5.3.5-1: *SAN channel bandwidths* and SCS per *operating band* in FR1-NTN

| SAN Operating Band | SCS (kHz) | *SAN channel bandwidth* (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | 30(NOTE) |
|  | 15 | 5 | 10 | 15 | 20 |  |
| n256 | 30 |  | 10 | 15 | 20 |  |
|  | 60 |  | 10 | 15 | 20 |  |
|  | 15 | 5 | 10 | 15 | 20 |  |
| n255 | 30 |  | 10 | 15 | 20 |  |
|  | 60 |  | 10 | 15 | 20 |  |
|  | 15 | 5 | 10 | 15 |  |  |
| n254 | 30 |  | 10 | 15 |  |  |
|  | 60 |  | 10 | 15 |  |  |
|  | 15 | 5 |  |  |  |  |
| [n251] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n250] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n249] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
| NOTE: Deployment of 30 MHz channel bandwidth for NTN SAN needs to be preceded by introduction of all applicable Tx RF, Rx RF, and demodulation requirements. |

Table 5.4.2.3-1: Applicable NR-ARFCN per *operating band* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| n256 | 100 | 396000 – <20> – 402000 | 434000 – <20> – 440000 |
| n255 | 100 | 325300 – <20> – 332100 | 305000 – <20> – 311800 |
| n254 | 100 | 322000 – <20> – 325300 | 496700 – <20> – 500000 |
| [n251] | 100 | 333600– <20> – 335000 | 303600 – <20> – 305000 |
| [n250] | 100 | 325300– <20> – 332100 | 303600 – <20> – 311800 |
| [n249] | 100 | 333600– <20> – 335000 | 303600 – <20> – 311800 |

Table 5.4.2.3-2: Applicable NR-ARFCN per *operating band* for enhanced channel raster

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| n256 | 10 | 396000 – <2> – 402000 | 434000 – <2> – 440000 |
| n255 | 10 | 325300 – <2> – 332100 | 305000 – <2> – 311800 |
| [n251] | 10 | 333600– <2> – 335000 | 303600 – <2> – 305000 |
| [n250] | 10 | 325300– <2> – 332100 | 303600 – <2> – 311800 |
| [n249] | 10 | 333600– <2> – 335000 | 303600 – <2> – 311800 |
| 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. These channel numbers shall also be such that the minimum guard band for each channel bandwidth and SCS specified in Table 5.3.3-1 are met for carriers located at the upper or lower edge of an operating band. |

Table 5.4.3.3-1: Applicable SS raster entries per *operating band* (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| n256 | 15 kHz | Case A | 5429 – <1> – 5494 |
| n255 | 15 kHz | Case A | 3818 – <1> – 3892 |
|  | 30 kHz | Case B | 3824 – <1> – 3886 |
| n254 | 15 kHz | Case A | 6215 – <1> – 6244 |
|  | 30 kHz | Case C | 6218 – <1> – 6241 |
| [n251] | 15 kHz | Case A | 3800 – <1> – 3807 |
| [n250] | 15 kHz | Case A | 3800 – <1> – 3892 |
|  | 30 kHz | Case B | 3806 – <1> – 3886 |
| [n249] | 15 kHz | Case A | 3800 – <1> – 3892 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [7]. |

 |
| [**R4-2412958**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412958.zip) | Huawei, HiSilicon | **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.****Proposal 2: RAN4 can trade-off the following implementation for the combined L-band.****Implementation 1: Two separate duplexers with additional switching: one duplexer is (DL 1518 – 1559 MHz, UL 1626.5 – 1660.5 MHz) and another one is (DL 1518 – 1559 MHz, UL 1668 – 1675 MHz).****Implementation 2: one big duplexer to cover the whole frequency range, i.e. DL 1518 – 1559 MHz, UL 1626.5 – 1675 MHz.** |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: General Aspects

*Sub-topic description:*

*Open issues and candidate options before meeting:*

#### Issue 3-1-1: Band Plan

* **Proposals**
	+ Option 1:
		- To support the combined L-band, introduce two NTN bands with the common DL block (at 1518-1559) and two UL blocks (at 1626.5-1660.5 and 1668-1675) (Apple)

Table 2-2: Exemplary band plan for the combined L-band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Acronym | NTN band | DL block (MHz) | UL block (MHz) | Size (MHz) |
| Combined L-band | xx1 | 1518-1559 | 1626.5-1660.5 | 41 (DL) / 34 (UL) |
| xx2 | 1518-1559 | 1668-1675 | 41 (DL) / 7 (UL) |

* + - Specify two new NR NTN bands, with band number n251 for n255 UL and n255+n253 (specified for NB-IoT – to be specified for NR) DL and band number n250 for n253 UL and 255+n253DL (Inmarsat, Viasat)

Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 – 1626.5 MHz | 2483.5 – 2500 MHz | FDD |
| n253 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| n252 | Reserved for S-band | FDD |
| n251 | 1626.5MHz – 1660.5MHz | 1518MHz – 1559MHz | FDD |
| n250 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

* + Option 2: Operating band and band numbering for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz) can be defined as Table 2.1-1.

Table 2.1-1: NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n251] | 1668 MHz - 1675 MHz | 1518 MHz - 1525 MHz | FDD |
| [n250] | 1626.5 MHz - 1660.5 MHz | 1518 MHz - 1559 MHz | FDD |
| [n249] | 1668 MHz - 1675 MHz | 1518 MHz - 1559 MHz | FDD |

* + Option 3: Other
* **Recommended WF**
	+ Consider the following three new NR NTN bands as a starting point:

Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n253] | 1668MHz – 1675MHz | 1518MHz – 1525MHz | FDD |
| [n251] | 1626.5MHz – 1660.5MHz | 1518MHz – 1559MHz | FDD |
| [n250] | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

#### Issue 3-1-2: Band Numbering

* **Proposals**
	+ Option 1: Specify two new NR NTN bands, with band number n251 for n255 UL and n255+n253 (specified for NB-IoT – to be specified for NR) DL and band number n250 for n253 UL and 255+n253DL (Inmarsat, Viasat)

Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 – 1626.5 MHz | 2483.5 – 2500 MHz | FDD |
| n253 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| n252 | Reserved for S-band | FDD |
| n251 | 1626.5MHz – 1660.5MHz | 1518MHz – 1559MHz | FDD |
| n250 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

* + Option 2: Operating band and band numbering for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz) can be defined as Table 2.1-1.

Table 2.1-1: NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| [n251] | 1668 MHz - 1675 MHz | 1518 MHz - 1525 MHz | FDD |
| [n250] | 1626.5 MHz - 1660.5 MHz | 1518 MHz - 1559 MHz | FDD |
| [n249] | 1668 MHz - 1675 MHz | 1518 MHz - 1559 MHz | FDD |

* + Option 3: Other
* **Recommended WF**
	+ Consider the following band numbering using n253, n251 and n250 as a starting point:

Table 1: NR-NTN satellite bands in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | Uplink (UL) operating bandSatellite Access Node receive / UE transmitFUL,low – FUL,high | Downlink (DL) operating bandSatellite Access Node transmit / UE receiveFDL,low – FDL,high  | Duplex mode |
| n253 | 1668MHz – 1675MHz | 1518MHz – 1525MHz | FDD |
| [n252] | Reserved for NTN S-band | FDD |
| n251 | 1626.5MHz – 1660.5MHz | 1518MHz – 1559MHz | FDD |
| n250 | 1668MHz – 1675MHz | 1518MHz – 1559MHz | FDD |
| NOTE: NTN satellite bands are numbered in descending order from n256. |

#### Issue 3-1-3: General Regulatory Background

* **Proposals**
	+ Option 1: (Inmarsat, Viasat)
		- ETSI EN 301 681 shall be used to assess the regulatory compliance of this new band, and shall be used to inform decisions on spectrum emissions related requirements such as A-MPR
		- FCC Part 25 clause 202 shall be used to assess the regulatory compliance of this new band, and shall be used to inform decisions on spectrum emissions related requirements such as A-MPR.
	+ Option 2: (ZTE Corporation, Sanechips)
		- Requirements for protection of the Radio Astronomy in the 1660-1670 MHz range shall be captured
	+ Other
* **Recommended WF**
	+ Consider the protection of Radio Astronomy as input to the requirements and for further discussion
	+ Companies to provide further input on the necessary regulatory background and further discuss what should be the relevant sources.
	+ Applicable regulation shall be captured in either existing or a new section in TR 38.863 for NTN L-bands.

#### Issue 3-1-4: General Coexistence Aspects

* **Proposals**
	+ Option 1: The scope of the study carried out in TR 38.863 shall also be true for this band definition when concerned with UE-UE coexistence (Inmarsat, Viasat)
	+ Option 2: other
* **Recommended WF**
	+ Reuse the assumptions from TR 38.863 as a starting point for further discussion.

#### Issue 3-1-3: Bands in scope for TN-NTN coexistence

* **Proposals**
	+ Option 1: Only n253 NR coexistence with n253 NTN UE as victim needs to be considered for the definition of these bands, and only for bands n74, n84, n92, n75 and n50 (Inmarsat, Viasat).
	+ Option 2: other
* **Recommended WF**
	+ TBA

### Sub-topic 3-2: System Parameters and UE RF

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 3-2-1: Channel Bandwidths

* Proposals
	+ Option 1: Firstly, supported channel bandwidths and SCS can be defined as Table 2.2-1. Whether to support 25, 35, 40 MHz channel bandwidth needs further study (ZTE Corporation, Sanechips)

Table 2.2-1: Channel bandwidths for each NTN satellite band in FR1-NTN

| NTN satellite band | SCSkHz | UE Channel bandwidth (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | 30(NOTE) |
|  | 15 | 5 |  |  |  |  |
| [n251] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n250] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
|  | 15 | 5 |  |  |  |  |
| [n249] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-2-2: Asymmetric Channel Bandwidth Support

* Proposals
	+ Option 1: New NTN bands [n250] and [n249] can support asymmetric channel bandwidths. (ZTE Corporation, Sanechips)
	+ Option 2: Other
* Recommended WF
	+ Agree to support for asymmetric channel bandwidths for the new NR NTN combined L-band bands and further discuss which channel bandwidth combinations can be supported.

#### Issue 3-2-3: Channel Raster and NR-ARFCN

* Proposals
	+ Option 1: NR-ARFCN for the new NR-NTN bands supporting 100 kHz and 10 kHz channel raster can be defined as Table 2.4-1 and Table 2.4-2, respectively. (ZTE Corporation, Sanechips)

Table 2.4-1: Applicable NR-ARFCN per operating band in FR1-NTN with 100 kHz channel rater

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| [n251] | 100 | 333600– <20> – 335000 | 303600 – <20> – 305000 |
| [n250] | 100 | 325300– <20> – 332100 | 303600 – <20> – 311800 |
| [n249] | 100 | 333600– <20> – 335000 | 303600 – <20> – 311800 |

Table 2.4-2: Applicable NR-ARFCN per operating band in FR1-NTN with 10 kHz channel rater

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTN satellite operating band | ΔFRaster(kHz) | UplinkRange of NREF(First – <Step size> – Last) | DownlinkRange of NREF(First – <Step size> – Last) | Mandatory support |
| [n251] | 10 | 333600– <2> – 335000 | 303600 – <2> – 305000 | Yes |
| [n250] | 10 | 325300– <2> – 332100 | 303600 – <2> – 311800 | Yes |
| [n249] | 10 | 333600– <2> – 335000 | 303600 – <2> – 311800 | Yes |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-2-4: GSCN and Sync Raster

* Proposals
	+ Option 1: We propose that band [n251] and [n249] support case A SSB pattern, and band [n250] supports case A and case B SSB pattern. Sync raster and GSCN for the these bands can be defined as Table 2.4-3. (ZTE Corporation, Sanechips)

Table 2.4-3: Applicable SS raster entries per operating band (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite operating band | SS Block SCS | SS Block pattern1 | Range of GSCN(First – <Step size> – Last) |
| [n251] | 15 kHz | Case A | 3800 – <1> – 3807 |
| [n250] | 15 kHz | Case A | 3800 – <1> – 3892 |
|  | 30 kHz | Case B | 3806 – <1> – 3886 |
| [n249] | 15 kHz | Case A | 3800 – <1> – 3892 |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-2-5: TX-RX Separation

* Proposals
	+ Option 1: The flexible TX-RX frequency separation for for the new NR-NTN bands should be defined as Table 2.5-1. (ZTE Corporation, Sanechips)

Table 2.5-1: UE TX-RX frequency separation (FR1-NTN)

| NTN Satellite Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| [n251] | 148 – 152 MHz |
| [n250] | 72.5 – 137.5 MHz |
| [n249] | 114 – 152 MHz |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-2-6: General Views on Impact to UE RF Requirements

* Proposals
	+ Option 1: General requirements do not need to be changed. Areas of concern are spectrum /coexistence related specification e.g. Spurious emissions, and some Rx requirements, REFSENS due to self interference and out of band blocking (Inmarsat, Viasat)

Table 3: Required changes compare to current spec TS 38.101-5 [3]
(Note: applicable to respective sections of TS 36.102)

|  |  |  |
| --- | --- | --- |
| Section | Requirement | Proposal for NR-NTN (Note: applicable also for IoT-NTN in respective sections of TS36.102) |
| **Tx requirements** |
| 6.2.1 | UE maximum output power | As proposed in the WID [1]PC3 for NR-NTN |
| 6.2.2 | UE maximum output power reduction | No changes  |
| 6.2.3 | UE additional maximum output power reduction | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.2.4 | Configured transmitted power | No changes |
| 6.3.1 | Minimum output power | No changes |
| 6.3.2 | Transmit OFF power | No changes |
| 6.3.3 | Transmit ON/OFF time mask | No changes |
| 6.3.4 | Power control | No changes |
| 6.4 | Transmit signal quality | No changes |
| 6.5.1 | Occupied bandwidth | No changes |
| 6.5.2 | Out of band emission (ACLR) | No changes |
| 6.5.3.1 | General Spurious emissions | No changes |
| 6.5.3.2 | Spurious emissions for UE co-existence | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.3.3 | Additional spurious emissions | FFS (Depends on Regulations requirement and UE Coexistence discussion) |
| 6.5.4 | Transmit intermodulation | No changes |
| **Rx requirements** |
| 7.3 | Reference sensitivity | FFS (tied to Tx-Rx separation discussion) |
| 7.4 | Maximum input level | No changes |
| 7.5 | Adjacent channel selectivity | No changes |
| 7.6.1 | General | No changes |
| 7.6.2 | In-band blocking | No changes |
| 7.6.3 | Out-of-band blocking | FFS (due to sub-n253 blocking requirement) |
| 7.6.4 | Narrow band blocking | Borrowed from n255 |
| 7.7 | Spurious response | No changes |
| 7.8 | Intermodulation characteristics | No changes |

* + Option 2: To use the proposals in Table 2.6-1 for UE RF requirements for the new NR-NTN bands. (ZTE Corporation, Sanechips)

**Table 2.6-1 UE RF requirements for the new NR-NTN bands**

|  |  |
| --- | --- |
| **NR-NTN UE Tx/Rx requirement** | **Proposals for the new NR-NTN bands** |
| 6.2.1 UE maximum output power | Band specific --> Specification impact. Support UE Power class 3 (+23dBm). |
| 6.2.2 MPR | Not band specific --> No specification impact. |
| 6.2.3 A-MPR | Band specific --> Specification impact. A-MPR requirement needs further study. |
| 6.2.4Configured transmitted power | Not band specific --> No specification impact. |
| 6.3.1 Minimum output power | Not band specific --> No specification impact. |
| 6.3.2 Transmit OFF power | Not band specific --> No specification impact. |
| 6.3.3 Transmit ON/OFF time mask | Not band specific --> No specification impact. |
| 6.3.4 Power control | Not band specific --> No specification impact. |
| 6.4.1 Frequency error | Not band specific --> No specification impact. |
| 6.4.2 Transmit modulation quality | Not band specific --> No specification impact. |
| 6.5.1 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.5.2.2 Spectrum emission mask | Not band specific --> No specification impact. |
| 6.5.2.3 Additional Spectrum emission mask | Specification impact.Requirements for protection of the Radio Astronomy in the 1660-1670 MHz range shall be captured. |
| 6.5.2.4.1 NR ACLR | Not band specific --> No specification impact. |
| 6.5.2.4.2 UTRA ACLR | Not band specific --> No specification impact. |
| 6.5.3.1 General spurious emissions | Not band specific --> No specification impact. |
| 6.5.3.2 Spurious emissions for UE co-existence | Specification impact. Bands [n251], [n250] and [n249] need to be added in Table 6.5.3.2-1. |
| 6.5.3.3 Additional spurious emissions | Specification impact.Requirements for protection of the Radio Astronomy in the 1660-1670 MHz range shall be captured. |
| 6.5.4 Transmit intermodulation | Not band specific --> No specification impact. |
| 7.3.2 Reference sensitivity  | Band specific --> Specification impact. REFSENS requirement needs to be defined for bands [n251], [n250] and [n249]. |
| 7.4 Max input level | Not band specific --> No specification impact. |
| 7.5 Adjacent channel selectivity | Not band specific --> No specification impact. |
| 7.6.2 In-band blocking | Specification impact --> Define in-band blocking requirement similar to band n254, n255, n256. |
| 7.6.3 Out of band blocking  | Specification impact --> Out-of-band blocking requirement needs to be defined for bands [n251], [n250] and [n249]. |
| 7.6.4 Narrow band blocking | Specification impact --> Define narrow band blocking requirement similar to band n254, n255, n256. |
| 7.7 Spurious response | Not band specific --> No specification impact. |
| 7.8 Intermodulation characteristics | Not band specific --> No specification impact. |
| 7.9 Spurious emissions | Not band specific --> No specification impact. |

* + Option 3: Other
* Recommended WF
	+ TBA.

#### Issue 3-2-7: Additional UE RX Blocking Requirements

* Proposals
	+ Option 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.
	+ Option 2: Other
* Recommended WF
	+ TBA

#### Issue 3-2-8: UE Duplexer

* Proposals
	+ RAN4 can trade-off the following implementation for the combined L-band (Huawei, HiSilicon).
		- Option 1: Two separate duplexers with additional switching: one duplexer is (DL 1518 – 1559 MHz, UL 1626.5 – 1660.5 MHz) and another one is (DL 1518 – 1559 MHz, UL 1668 – 1675 MHz).
		- Option 2: one big duplexer to cover the whole frequency range, i.e. DL 1518 – 1559 MHz, UL 1626.5 – 1675 MHz.
* Recommended WF
	+ TBA

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

*Sub-topic description*

*Open issues and candidate options before meeting:*

#### Issue 3-3-1: SAN Operating Bands

* Proposals
	+ Option 1: draftCR to TS38.108 Introduction of NR-NTN combined L-band (ZTE Corporation, Sanechips)

Table 5.2-1: Satellite *operating bands* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| Satellite *operating band* | Uplink (UL) *operating band*SAN receive / UE transmitFUL,low – FUL,high | Downlink (DL) *operating band*SAN transmit / UE receiveFDL,low – FDL,high | Duplex mode |
| n256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| n254 | 1610 MHz – 1626.5 MHz  | 2483.5 MHz – 2500 MHz | FDD |
| [n251] | 1668 MHz - 1675 MHz | 1518 MHz - 1525 MHz | FDD |
| [n250] | 1626.5 MHz - 1660.5 MHz | 1518 MHz - 1559 MHz | FDD |
| [n249] | 1668 MHz - 1675 MHz | 1518 MHz - 1559 MHz | FDD |
| NOTE: Satellite bands are numbered in descending order from n256. |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers

#### Issue 3-3-2: SAN Channel Bandwidths

* Proposals
	+ Option 1: draftCR to TS38.108 Introduction of NR-NTN combined L-band (ZTE Corporation, Sanechips)

Table 5.3.5-1: *SAN channel bandwidths* and SCS per *operating band* in FR1-NTN

| SAN Operating Band | SCS (kHz) | *SAN channel bandwidth* (MHz) |
| --- | --- | --- |
| 5 | 10 | 15 | 20 | 30(NOTE) |
|  | 15 | 5 | 10 | 15 | 20 |  |
| n256 | 30 |  | 10 | 15 | 20 |  |
|  | 60 |  | 10 | 15 | 20 |  |
|  | 15 | 5 | 10 | 15 | 20 |  |
| n255 | 30 |  | 10 | 15 | 20 |  |
|  | 60 |  | 10 | 15 | 20 |  |
|  | 15 | 5 | 10 | 15 |  |  |
| n254 | 30 |  | 10 | 15 |  |  |
|  | 60 |  | 10 | 15 |  |  |
|  | 15 | 5 |  |  |  |  |
| [n251] | 30 |  |  |  |  |  |
|  | 60 |  |  |  |  |  |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n250] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
|  | 15 | 5 | 10 | 15 | 20 | 30 |
| [n249] | 30 |  | 10 | 15 | 20 | 30 |
|  | 60 |  | 10 | 15 | 20 | 30 |
| NOTE: Deployment of 30 MHz channel bandwidth for NTN SAN needs to be preceded by introduction of all applicable Tx RF, Rx RF, and demodulation requirements. |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers

#### Issue 3-3-3: SAN Channel Raster and EARFCN

* Proposals
	+ Option 1: draftCR to TS38.108 Introduction of NR-NTN combined L-band (ZTE Corporation, Sanechips)

Table 5.4.2.3-1: Applicable NR-ARFCN per *operating band* in FR1-NTN

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| n256 | 100 | 396000 – <20> – 402000 | 434000 – <20> – 440000 |
| n255 | 100 | 325300 – <20> – 332100 | 305000 – <20> – 311800 |
| n254 | 100 | 322000 – <20> – 325300 | 496700 – <20> – 500000 |
| [n251] | 100 | 333600– <20> – 335000 | 303600 – <20> – 305000 |
| [n250] | 100 | 325300– <20> – 332100 | 303600 – <20> – 311800 |
| [n249] | 100 | 333600– <20> – 335000 | 303600 – <20> – 311800 |

Table 5.4.2.3-2: Applicable NR-ARFCN per *operating band* for enhanced channel raster

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | ΔFRaster(kHz)  | Uplinkrange of NREF(First – <Step size> – Last) | Downlinkrange of NREF(First – <Step size> – Last) |
| n256 | 10 | 396000 – <2> – 402000 | 434000 – <2> – 440000 |
| n255 | 10 | 325300 – <2> – 332100 | 305000 – <2> – 311800 |
| [n251] | 10 | 333600– <2> – 335000 | 303600 – <2> – 305000 |
| [n250] | 10 | 325300– <2> – 332100 | 303600 – <2> – 311800 |
| [n249] | 10 | 333600– <2> – 335000 | 303600 – <2> – 311800 |
| 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. These channel numbers shall also be such that the minimum guard band for each channel bandwidth and SCS specified in Table 5.3.3-1 are met for carriers located at the upper or lower edge of an operating band. |

* + Option 2: Other
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-3-4: SAN GSCN and Sync Raster

* Proposals
	+ Option 1: draftCR to TS38.108 Introduction of NR-NTN combined L-band (ZTE Corporation, Sanechips)

Table 5.4.3.3-1: Applicable SS raster entries per *operating band* (FR1-NTN)

|  |  |  |  |
| --- | --- | --- | --- |
| SAN operating band | SS Block SCS | SS Block pattern(NOTE) | Range of GSCN(First – <Step size> – Last) |
| n256 | 15 kHz | Case A | 5429 – <1> – 5494 |
| n255 | 15 kHz | Case A | 3818 – <1> – 3892 |
|  | 30 kHz | Case B | 3824 – <1> – 3886 |
| n254 | 15 kHz | Case A | 6215 – <1> – 6244 |
|  | 30 kHz | Case C | 6218 – <1> – 6241 |
| [n251] | 15 kHz | Case A | 3800 – <1> – 3807 |
| [n250] | 15 kHz | Case A | 3800 – <1> – 3892 |
|  | 30 kHz | Case B | 3806 – <1> – 3886 |
| [n249] | 15 kHz | Case A | 3800 – <1> – 3892 |
| NOTE: SS Block pattern is defined in clause 4.1 in TS 38.213 [7]. |

* + Option 2: TBA
* Recommended WF
	+ Consider Option 1 as a starting point for further discussion after correcting the band numbers.

#### Issue 3-3-5: SAN TX Requirements Impact

* Proposals
	+ Option 1: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz). (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new NR-NTN bands**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN bands** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN --> No specification impact. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar to band n254, n255, n256. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN --> No specification impact. |

* + Option 2: Other
* Recommended WF
	+ TBA

#### Issue 3-3-6: SAN RX Requirements Impact

* Proposals
	+ Option 1: To use the proposals in Table 1 for SAN RF requirements for the new NR-NTN bands supporting the Extended L-band (UL 1668-1675MHz, DL 1518-1525MHz) and the combined MSS L-band and Extended L-band ranges (DL 1518-1559 MHz, UL 1626.5-1660.5 MHz and 1668-1675 MHz). (ZTE Corporation, Sanechips)

**Table 1: SAN RF requirements for the new NR-NTN bands**

|  |  |
| --- | --- |
| **NR BS RF Tx/Rx requirement** | **Proposal for the new NR-NTN bands** |
| 6.2 Satellite Access Node output power  | Not band specific --> No specification impact. |
| 6.3.2 RE power control dynamic range | Not band specific --> No specification impact. |
| 6.3.3 Total power dynamic range | Not band specific --> No specification impact. |
| 6.4 Transmit ON/OFF power | Not applicable to SAN --> No specification impact. |
| 6.5 Transmitted signal quality | Not band specific --> No specification impact. |
| 6.6.2 Occupied bandwidth | Not band specific --> No specification impact. |
| 6.6.3 Adjacent Channel Leakage Power Ratio | Not band specific --> No specification impact. |
| 6.6.4 Out-of-band emissions | Band specific --> Specification impact. Consider define out-of-band emissions requirement similar to band n254, n255, n256. |
| 6.6.5 Transmitter spurious emissions | No specification impact. |
| 6.7 Transmitter intermodulation | Not applicable to SAN --> No specification impact. |
| 7.2 Reference sensitivity level  | Not band specific --> No specification impact. |
| 7.3 Dynamic range | Not band specific --> No specification impact. |
| 7.4.1 Adjacent Channel Selectivity (ACS) | Not band specific --> No specification impact. |
| 7.4.2 In-band blocking | Not applicable for SAN --> No specification impact. |
| 7.5 Out-of-band blocking  | Not band specific --> No specification impact. |
| 7.6 Receiver spurious emissions | Not applicable for SAN --> No specification impact. |
| 7.7 Receiver intermodulation | Not applicable for SAN --> No specification impact. |

* + Option 2: Other
* Recommended WF
	+ TBA