**3GPP TSG-RAN WG4 Meeting # 100-e R4-210XXXX**

**Electronic Meeting, 16th-27th of August, 2021**

**Agenda item:** 9.13.1,9.13.1.1, 9.13.1.2, 9.13.1.3, 9.13.1.4

**Source:** Moderator (THALES)

**Title:** Email discussion summary for [100-e][312] NTN\_Solutions\_Part1

**Document for:** Information

# Introduction

This discussion summary document captures general issues related to RAN4 RF part Rel-17 NR NTN WI, including system parameters, NTN class/Type, and regulatory discussions, including exemplary bands. It contains a summary of the contributions under sections and subsections 9.13.1.1, 9.13.1.2, 9.13.1.3, 9.13.1.4 at TSG-RAN WG4 #100-e, together with identified key open issues and recommends topics/questions to be handled via email discussions. The goal of this document is to provide recommendation on prioritization of discussion.

Please also note the draft TSG-RAN WG4 #100-e meeting agenda with respect to NTN topic:

9.13 Solutions for NR to support non-terrestrial networks (NTN) [NR\_NTN\_solutions]

9.13.1 General and work plan [NR\_NTN\_solutions-Core]

9.13.1.1 System parameters [NR\_NTN\_solutions-Core]

9.13.1.2 NTN gNB Class/Type [NR\_NTN\_solutions-Core]

9.13.1.3 Regulatory information [NR\_NTN\_solutions-Core]

9.13.1.4 Others [NR\_NTN\_solutions-Core]

9.13.2 Coexistence aspects [NR\_NTN\_solutions-Core]

9.13.2.1 Coexistence scenarios and Simulation assumptions [NR\_NTN\_solutions-Core]

9.13.2.2 Simulation results [NR\_NTN\_solutions-Core]

9.13.3 BS RF requirements [NR\_NTN\_solutions-Core]

9.13.3.1 TX requirements [NR\_NTN\_solutions-Core]

9.13.3.2 RX requirements [NR\_NTN\_solutions-Core]

9.13.4 UE RF requirements [NR\_NTN\_solutions-Core]

9.13.4.1 TX requirements [NR\_NTN\_solutions-Core]

9.13.4.2 RX requirements [NR\_NTN\_solutions-Core]

9.13.5 RRM core requirements [NR\_NTN\_solutions-Core]

9.13.5.1 General and RRM requirements impacts [NR\_NTN\_solutions-Core]

9.13.5.2 GNSS-related requirements [NR\_NTN\_solutions-Core]

9.13.5.3 Mobility requirements [NR\_NTN\_solutions-Core]

9.13.5.4 Timing requirements [NR\_NTN\_solutions-Core]

9.13.5.5 Measurement procedure requirements [NR\_NTN\_solutions-Core]

\* Include SMTC and measurement gap under 9.13.5.5

For informative purpose, RAN4#100-e E-meeting Arrangements and Guidelines proposed the following schedule:

* Moderators provide initial summary (Draft) by Thursday August 12th, 5pm UTC
* Companies can provide comments on initial summary by Friday August 13th, 5pm UTC
* Moderators kick off email discussion (Monday August 16th)
* Companies provide comments for the 1st round (Monday August 16th – Thursday 5pm UTC August 19th)
* Moderators summarize the status and possible proposals, recommending what decisions can be made for 1st round. A formal t-doc will be used (Friday 5pm UTC August 20th)
* Moderators kick off 2nd round email discussion (no later than Monday 3am UTC August 23rd)
* After receiving the summary from moderators, session chair may approve documents, make agreements or assign new CRs, WFs, LSs, etc. (Monday 8am UTC August 23rd)
* Draft WF/LS and revised CRs/TPs shall be shared by Tuesday 5pm UTC August 24th
* Companies provide comments for the 2nd round summary (no later than Wednesday 5pm UTC August 25th)
* Moderators provide 2nd round WF draft by Wednesday 7pm UTC, August 25th.
* Moderators provide 2nd round draft summary by Thursday 11:59 UTC, August 26th.
* Formal tdocs of WF/LS/CRs/TPs shall be uploaded to the Inbox by Thursday 5pm UTC, August 26th.
* Moderators provide 2nd round summary with a formal tdoc by Friday 8am UTC, August 27th.

A total of **22** TDocs have been identified for discussion in **[100-e][312] NTN\_Solutions\_Part1**, including 2 documents from other AIs (please also see the **Appendix** for the details, with all the observations/proposals):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company*** | ***Status*** | ***General Purpose*** | ***Agenda Item*** |
| [R4-2114469](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114469.zip) | discussion | MSS S-Band range (1980-2010 and 2170-2200 MHz) for NTN-FR1 and its adjacent bands | Hughes/EchoStar, Inmarsat, Sateliot, Thales | available | Agreement | 9.13.1 |
| [R4-2112390](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112390.zip) | discussion | NR NTN and Irregular Channel Bandwidths | GLOBALSTAR Inc. | available | Decision | 9.13.1.1 |
| [R4-2111932](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111932.zip) | discussion | Further discussion on NTN System parameters | CATT | available | Discussion | 9.13.1.1 |
| [R4-2113745](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113745.zip) | other | NTN - System parameters | Ericsson | available | Approval | 9.13.1.1 |
| [R4-2113689](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113689.zip) | discussion | On NTN System parameters | Nokia, Nokia Shanghai Bell | available | Approval | 9.13.1.1 |
| [R4-2113928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113928.zip) | Other | Discussion on system parameters for NTN | ZTE Corporation | available | Approval | 9.13.1.1 |
| [R4-2113183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113183.zip) | Discussion | system parameter for NTN network | CMCC | available | Discussion | 9.13.1.1 |
| [R4-2112145](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112145.zip) | Discussion | Considerations on BS type and BS class | SoftBank Corp., Deutsche Telekom | available | Discussion | 9.13.1.2 |
| [R4-2112009](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112009.zip) | Discussion | Discussion on NTN gNB type/class | CATT | available | Discussion | 9.13.1.2 |
| [R4-2113184](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113184.zip) | Discussion | NTN gNB Class and Types | CMCC | available | Discussion | 9.13.1.2 |
| [R4-2113929](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113929.zip) | Other | Discussion on NTN gNB class and type | ZTE Corporation | available | Approval | 9.13.1.2 |
| [R4-2113744](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113744.zip) | Other | NTN - BS Class and Type | Ericsson | available | Approval | 9.13.1.2 |
| [R4-2114410](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114410.zip) | Discussion | Ka band consideration for FR2 NTN | Huawei | available | Discussion | 9.13.1.3 |
| [R4-2113741](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113741.zip) | Other | NTN - Regulatory information | Ericsson | available | Approval | 9.13.1.3 |
| [R4-2114412](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114412.zip) | Discussion | On the NTN bands numbering | Huawei | available | Discussion | 9.13.1.4 |
| [R4-2114471](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114471.zip) | Discussion | On the New NTN Specifications Titles and their Scope | THALES | available | Discussion | 9.13.1.4 |
| [R4-2113740](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113740.zip) | Other | NTN – General | Ericsson | available | Approval | 9.13.1.4 |
| [R4-2113430](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113430.zip) | Other | General discussion on how to arrange the specifications for satellite communication system | Huawei, HiSilicon | available | Approval | 9.13.1.4 |
| [R4-2113450](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113450.zip) | Discussion | Discussion on NTN specification | CATT | available | Discussion | 9.13.1.4 |
| [R4-2113451](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113451.zip) | LS out | LS on NTN network architecture | CATT | available | Approval | 9.13.1.4 |
| [R4-2112517](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112517.zip) | draft TR | Skeleton of TR 38.863 for NTN related RF and co-existence aspects | Samsung | available | Approval | 9.13.2 |
| [R4-2112391](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112391.zip) | Discussion | NR NTN and Irregular Channel Bandwidths | GLOBALSTAR Inc. | available | Decision | 10.2.1 |

**Moderator note1:** T-doc R4-2114469 (from AI 9.13.1) will be partially considered under **[100-e][312] NTN\_Solutions\_Part1**. The discussions concerning the coexistence analysis and related RAN4 simulation work will be considered under **[100-e][313] NTN\_Solutions\_Part2**.

**Moderator note2:** T-doc R4-2112517 (from AI 9.13.2) will be handled in **[100-e][312] NTN\_Solutions\_Part1**.

**Moderator note3:** T-doc R4-2112391 (from AI 10.2.1) will be handled in **[100-e][312] NTN\_Solutions\_Part1**. Since R4-2112390 and R4-2112391 are identical, the contributions will be treated together.

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

Identified topics and issues for the 1st round:

1. Topic #1: NTN System Parameters
   1. Issue 1-1-1: MSS S-Band Range Clarification
   2. Issue 1-1-2: MSS L-Band Range Clarification
   3. Issue 1-2-1: NTN Band Coding and Signalling Design
   4. Issue 1-2-2: NTN Band Numbering
   5. Issue 1-3-1: NTN Channel BandWidth
   6. Issue 1-3-2: NTN Channel Spacing
   7. Issue 1-4-1: NTN Channel Raster
   8. Issue 1-4-2: NTN Synchronization Raster
   9. Issue 1-4-3: NTN ARFCN and GSCN
2. Topic #2: NTN gNB Class/Type
   1. Issue 2-1-1: Satellite NTN gNB Type
   2. Issue 2-2-1: Satellite NTN gNB Class - general
   3. Issue 2-2-2: Criteria for defining NTN gNB Class
3. Topic #3: General Band Related Parameters
   1. Issue 3-1-1: Irregular Channel BW - general
   2. Issue 3-1-2: Irregular Channel BW allocation from L-Band and S-band
   3. Issue 3-2-1: SU Discussion
   4. Issue 3-3-1: ITU Recommendation for S-Band
4. Topic #4: New NTN TR and TS Titles and Scope
   1. Issue 4-1-1: Titles and Scope of NTN NR TR and TS - general
   2. Issue 4-1-2: Title and Scope of NTN NR TR 38.863
   3. Issue 4-1-3: Title and Scope of NTN NR TS 38.108
   4. Issue 4-1-4: Title and Scope of NTN NR TS 38.181
   5. Issue 4-2-1: Table of Contents for NTN NR TR 38.863
   6. Issue 4-3-1: Introduction of New Specific UE TS for UE NTN NR
   7. Issue 4-4-1: LS to RAN-P
   8. Issue 4-4-2: LS to RAN3
5. Topic #5: HAPS Generalities
   1. Issue 5-1-1: Spectrum usage for HAPS
   2. Issue 5-1-2: FR1 Spectrum for HAPS operation
   3. Issue 5-2-1: HAPS and TN operations
   4. Issue 5-3-1: BS type for HAPS
   5. Issue 5-4-1: BS class for HAPS
6. Topic #6: FR2 Generalities
   1. Issue 6-1-1: RAN4 work on FR2 band support for NTN
   2. Issue 6-2-1: LS to RAN-P on 7-24 GHz usage
   3. Issue 6-3-1: Potential FR2 Numbering (if needed in the future)

# Topic #1: NTN System Parameters

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

## Companies’ contributions summary

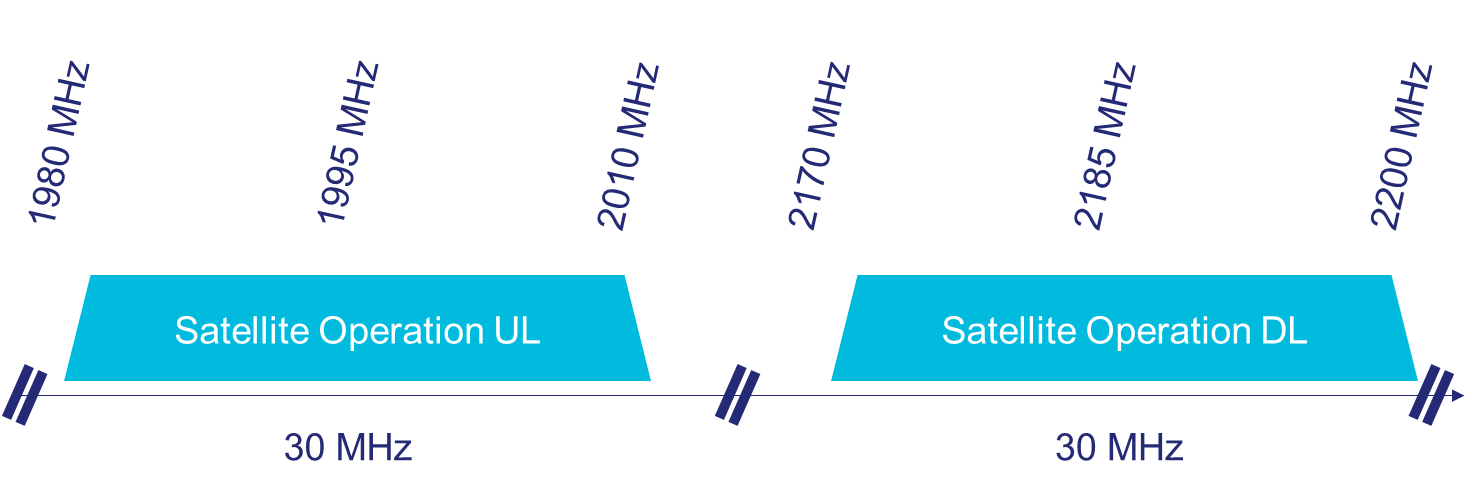
|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2114469](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114469.zip) | Hughes/EchoStar, Inmarsat, Sateliot, Thales | Figure 1: MSS S-Band 1980-2010 and 2170-2200 MHz [2] to be adapted for NTN-NR band  **Observation 1:** RAN4#98-e endorsed MSS S-Band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as the NTN FR1 exemplary band, to be completed in Rel-17.  **Proposal 1:** RAN4 work to focus on the MSS specific range [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] for the NTN FR1 exemplary band.  **Observation 2:** In the US and Canada, the MSS S-band has been assigned for terrestrial use on a national basis. Therefore the MSS S-band definition for NTN-NR in this range will not apply for US and Canada [3].  **Observation 3**: The MSS S-Band range for Mexico is not aligned with 1980-2010 and 2170-2200 MHz.  **Proposal 2:** The MSS S-band definition for NTN-NR [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as part of the Rel-17 NR-NTN WI does not apply for North America (US, Canada and Mexico). |
| [R4-2112390](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112390.zip)  and  [R4-2112391](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112391.zip) | GLOBALSTAR Inc. | Table 1: Regulatory parameters of the L-band and S-band   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Band** | **Frequencies (MHz)** | **Direction** | **Total BW (MHz)** | **Regions** | | **L-band** | 1518-1559 | Space to Earth (DL) | 41MHz (DL) | 1, 2, 3 | | 1610-1613.8 | Earth to Space (UL) | 3.8MHz (UL) | | 1613.8-1626.5 | Earth to Space (UL)  Space to Earth (DL) | 12.7MHz (UL/DL) | | 1626.5-1660.5 | Earth to Space (UL) | 34MHz (UL) | | 1668-1668.4 | Earth to Space (UL) | 7MHz (UL) | | 1668.4-1670 | Earth to Space (UL) | | 1670-1675 | Earth to Space (UL) | |  |  |  |  |  | | **S-band** | 1980-2010 | Earth to Space (UL) | 30MHz (UL) | 1, 2, 3 | | 2010-2025 | Earth to Space (UL) | 15MHz (UL) | 2 | | 2160-2170 | Space to Earth (DL) | 10MHz (DL) | 2 | | 2170-2200 | Space to Earth (DL) | 30MHz (DL) | 1, 2, 3 | | 2483.5-2500 | Space to Earth (DL) | 16.5MHz (DL) | 1, 2, 3 | | 2500-2520 | Space to Earth (DL) | 20MHz (DL) | 3 | | 2670-2690 | Earth to Space (UL) | 20MHz (UL) | 3 |   **Observation 1:** While most of the S-band satellite allocations match NR standard channel bandwidths, there are allocations on the S-band, and especially on the L-band, size of which is "irregular".  **Observation 2:** Using next smaller NR standard channel will result in quite noticeable resource wastage.  **Observation 3:** 3GPP has an ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths" where solutions for irregular channel bandwidths are considered.  **Proposal 1:** We ask 3GPP to consider NTN irregular channel bandwidths in the context of the ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths".  **Proposal 2:** As an operator request, we ask to consider irregular channel bandwidths from L-band (1610–1618.725MHz) and S-band (2483.5–2500MHz) spectrum allocations. |
| [R4-2111932](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111932.zip) | CATT | **Proposal 1: Define FR1 as 410 MHz ~ 7125 MHz in Rel-17 and defer FR2 definition to Rel-18.**  **Proposal 2: The same set of band coding and signaling design should be used for NTN and NR. The NTN band is numbered in reverse order from the maximum NR band number in each FR.**  **Proposal 3: The NTN band should be numbered as a new band even though it is fully overlapped with a TN band.**  **Proposal 4: The channel bandwidth and the number of RBs can be reused from TN. The supported channel bandwidths need to be specified for the new NTN band.**  **Proposal 5: Current channel spacing definition in TS 38.104 is applicable for NTN system.**  **Proposal 6: Current channel raster defined in TS38.104 can be applied for NTN system. Channel raster entries for NTN band need to be specified.**  **Proposal 7: The synchronization raster entries for NTN bands need further study based on operator input.** |
| [R4-2113745](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113745.zip) | Ericsson | **Proposal1: Specify the following system parameters for NTN s1 and s2 bands:**   |  |  |  |  | | --- | --- | --- | --- | | NTN *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode | | s11 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD | | s2 | 1626.5 MHz – 1660 5 MHz | 1525 MHz – 1559 MHz | FDD | | NOTE 1: Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision) | | | |  | NTN Band | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | | --- | --- | --- | --- | --- | --- | |  | 15 | Yes | Yes | Yes | Yes | | s1 | 30 |  | Yes | Yes | Yes | |  | 60 |  | Yes | Yes | Yes | |  | 15 | Yes | Yes | Yes | Yes | | s2 | 30 |  | Yes | Yes | Yes | |  | 60 |  | Yes | Yes | Yes |   **Proposal2: Further study if NTN ARFCN and GSCN should be simplified, reducing the range of values.** |
| [R4-2113928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113928.zip) | ZTE Corporation | **Proposal 1**: NTN band numbering could still follow the “first come first served ” principle  **Proposal 3**: for NTN S band, the following system parameters should be adopted.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR operating band | UL [MHz] | | DL [MHz] | | Duplexer | Fglobal [KHz] | channel raster [KHz] | UL NREF | | DL NREF | | SSB Block SCS [KHz] | SSB Pattern | GSCN\_L | GSCN\_H | | [10x] ? | 1980 | 2010 | 2170 | 2200 | FDD | 5 | 100 | 396000 | 402000 | 434000 | 440000 | 15 | Case A | 5429 | 5494 | |
| [R4-2113183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113183.zip) | CMCC | **Observation 1: there are three options for NTN band numbering scheme as below.**   * **Option 1: reserve some contiguous operating band numbers for NTN network** * **Option 2: start NTN number from the maximum operating number (n256) in NR spec and then define band number in descending order.** * **Option 3: define NTN operating band number just after the maximum numbers that has been used by NR system**   **Proposal 1: define NTN band number in increasing order after the maximum band number that has been used by NR system when new NTN bands are proposed.**  Table 2: S band definition for NTN networks   |  |  |  |  | | --- | --- | --- | --- | | **NR *operating band*** | **Uplink (UL) *operating band* BS receive / UE transmit**  **FUL,low – FUL,high** | **Downlink (DL) *operating band* BS transmit / UE receive**  **FDL,low – FDL,high** | **Duplex Mode** | | n100 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |   **Proposal 2: S band is suggested to be defined as in table 2.** |
| [R4-2113741](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113741.zip) | Ericsson | **Proposal1: The first band NTN based on L-band will have the following frequency range definition: 1626.5-1660.5 MHz in UL and 1525-1559 MHz in DL.**  **Proposal2: Add a note to the definition of the new band s1 ([4]) mentioning that: “Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision)”.** |
| [R4-2114412](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114412.zip) | Huawei | **Proposal 1**: agree on the NTN bands numbering based on the following principles:   * No separate NR bands numbering range for NTN, * NTN bands numbering to reuse the existing band numbering range for FR1 (and for FR2, if needed in future).   **Proposal 2**: The first NTN band to be allocated the next available FR1 band number, i.e. n100 (the number to be confirmed to avoid conflict with other spectrum work items).   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 5.2 *Operating bands* NR is designed to operate in the *operating bands* defined in table 5.2-1 and 5.2-2.  NB-IoT is designed to operate in the NR operating bands n1, n2, n3, n5, n7, n8, n12, n14, n18, n20, n25, n28, n41, n65, n66, n70, n71, n74, n90 which are defined in Table 5.2-1.  NTN is designed to operate in the NR operating band n100, [NTNband#2\_n101], [NTNband#3\_n263] which are defined in Table 5.2-1 [and Table 5.2-2].  Table 5.2-1: NR *operating bands* in FR1   |  |  |  |  | | --- | --- | --- | --- | | NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode | | n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD | | n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD | | n65 | 1920 MHz – 2010 MHz | 2110 MHz – 2200 MHz | FDD | | n84 | 1920 MHz – 1980 MHz | N/A | SUL | | n951 | 2010 MHz – 2025 MHz | N/A | SUL | | n996 | 1626.5 MHz -1660.5 MHz | N/A | SUL | | n100 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD | | [NTNband#2\_n101] | TBD | TBD | TBD |   Table 5.2-2: NR *operating bands* in FR2   |  |  |  | | --- | --- | --- | | NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode | | n257 | 26500 MHz – 29500 MHz | TDD | | n258 | 24250 MHz – 27500 MHz | TDD | | n259 | 39500 MHz – 43500 MHz | TDD | | n260 | 37000 MHz – 40000 MHz | TDD | | n261 | 27500 MHz – 28350 MHz | TDD | | n262 | 47200 MHz – 48200 MHz | TDD | | [NTNband#3\_n263] | TBD | TDD | | |
|  |  |  |

## Open issues summary

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

**RAN4#99-e Agreements (R4-2108099):**

* **Proposal 2-1-2-1:** The common definition for channel bandwidth, transmission bandwidth configuration, minimum guard band, and RB alignment in 38.104 and 38.101-1 can be reused for NTN system.
* **Proposal 2-1-3-1:** The supported channel bandwidth per operating band should be defined based on NTN operator input.
* **Proposal 2-1-4-1:** The channel spacing in 38.104 can be reused for NTN. Exact definition pending channel raster decision.
* **Proposal 2-2-1-1:** UE NTN FR1 may use similar specification as TS 38.101-1 (with different clauses for NTN).
* **Proposal 2-1-1-1:** The first NTN band will have the following frequency range definition: 1980-2010 MHz in UL and 2170-2200 MHz in DL. Its band number is FFS.
  + **Note:** Companies are encouraged to provide a NTN band numbering scheme for next RAN4 meeting.
* **Proposal 3-1-2-1:** RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 15 kHz: 5, 10, 15, 20 MHz.
* **Proposal 3-1-3-1:** RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 30 kHz and SCS 60 kHz: 10, 15, 20 MHz.
* **Proposal 3-1-3-2:** The supported channel bandwidth per operating band should be defined based on NTN operator input.
* **Proposal 3-1-5-1:** RAN4 shall consider a 100 kHz MSS S-Band Channel Raster.
* **Proposal 3-1-6-1:** With respect to MSS S-Band Synchronization Raster, one solution is to reuse current NR work frame for NTN system, but for applicable SS raster entries per operating band RAN4 may need to further study it.
* **Proposal 3-2-2-1:** RAN4 shall consider a 100 kHz MSS L-Band Channel Raster.
* **Proposal 3-1-1-1:** RAN4 shall use S-Band Reference Operational Deployment Scenario using 1980-2010 MHz for UL and 2170-2200 MHz for DL.



### Sub-topic 1-1

*Sub-topic description:* **MSS clarification with respect to NTN RAN4 work**

**Moderator note:** Please see RAN#99e agreements. The MSS S-band frequency range of 1980-2010 MHz for UL and 2170-2200 MHz for DL for S-band has been agreed.

**RAN4#99-e Agreements (R4-2108099):**

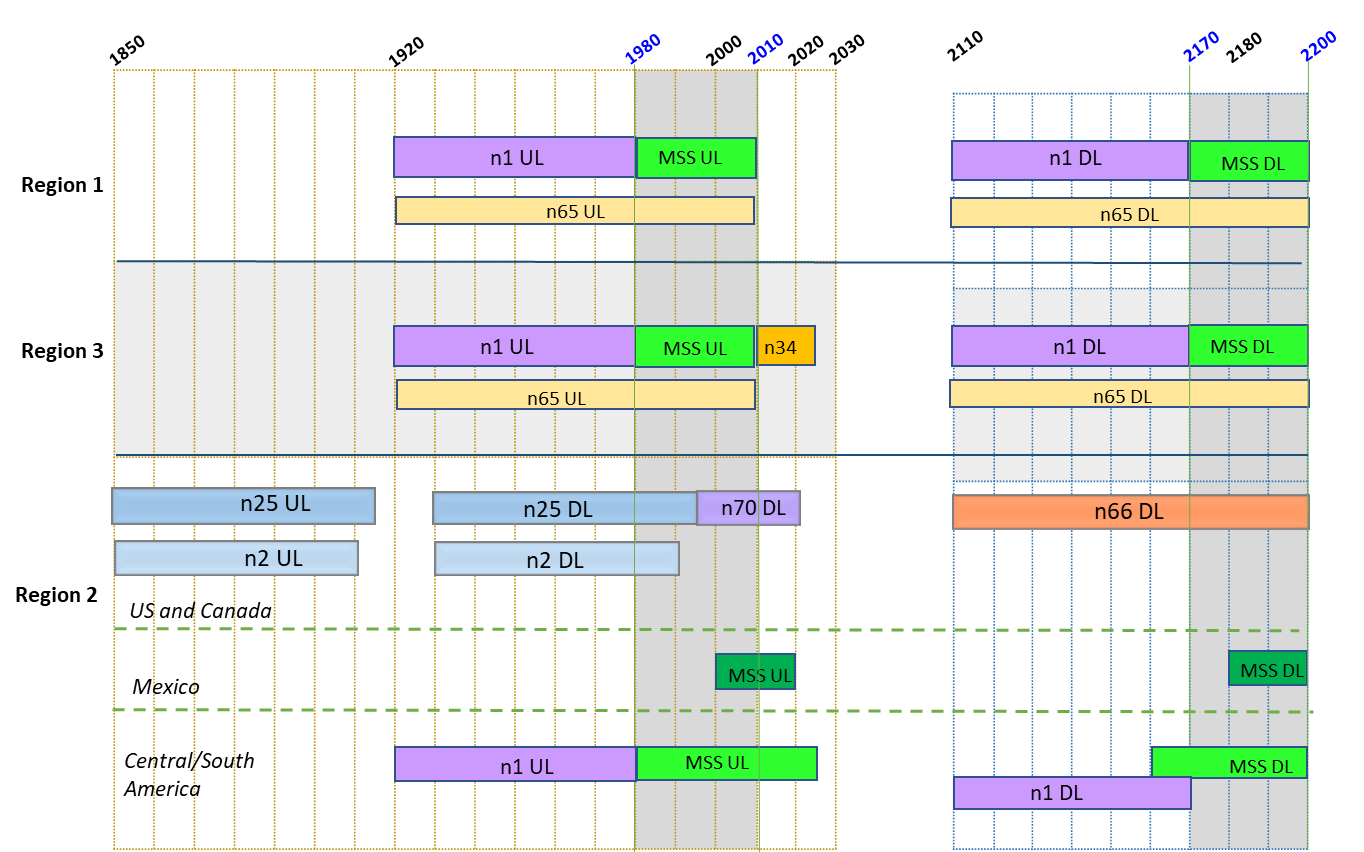
* **Proposal 2-1-1-1:** The first NTN band will have the following frequency range definition: 1980-2010 MHz in UL and 2170-2200 MHz in DL. Its band number is FFS.
  + **Note:** Companies are encouraged to provide a NTN band numbering scheme for next RAN4 meeting.

Therefore, it has been already decided that RAN4 work to focus on the MSS specific range [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] for the NTN FR1 exemplary band. However, unclear on the adaptability for all regions.

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: MSS S-Band Range** Clarification **with respect to NTN RAN4 work**

* Proposals
  + Option 1: RAN4 work to focus on the MSS specific range [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] for the NTN FR1 exemplary band. The MSS S-band definition for NTN-NR [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as part of the Rel-17 NR-NTN WI does not apply for North America (US, Canada and Mexico).



* Recommended WF
  + Option 1, if agreeable.

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | **Agree** |  |
| CATT | Agree |  |
| Ericsson | Agree |  |
| Samsung | Agree | We are OK with Option 1. The spectrum shall follow the regional and country specific regulations. |
| Xiaomi | Agree |  |
| Qualcomm | Agree |  |
| Hughes/EchoStar | Agree |  |
| Huawei | Agree |  |
| T-Mobile USA | Disagree | Brazil is the only country in Latin America that uses Band 1. Mexico, Peru, Belize, Colombia, El Salvador, Nicaragua, Panama, Paraguay and Uruguay all use Band 2. <https://en.wikipedia.org/wiki/List_of_LTE_networks>  So, the figure should show Band 2 in Mexico and Central/South America, and the text needs to be revised as follows:  o Option 1: RAN4 work to focus on the MSS specific range [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] for the NTN FR1 exemplary band. The MSS S-band definition for NTN-NR [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as part of the Rel-17 NR-NTN WI does not apply for Region 2~~North America (US, Canada and Mexico)~~. |
| THALES | Agree | At least Brazil, Costa Rica, could be also considered. |
| Nokia | Agree | We are also okay with the proposed update from TMO |
| Apple | Agree | Do we need to clarify that a particular band applies in a particular region? This is quite a normal situation when RAN4 defines a “regional” band, but it is not mentioned in the specifications that it is for a particular region. Further operator input is welcome. |
| ESA | Agree |  |
| Inmarsat | Agree |  |
| Sateliot | Agree |  |

*Open issues and candidate options before e-meeting:*

**Issue 1-1-2: MSS L-Band Range** Clarification **with respect to NTN RAN4 work**

* Proposals

|  |  |  |  |
| --- | --- | --- | --- |
| NTN *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| [s2] | 1626.5 MHz – 1660 5 MHz | 1525 MHz – 1559 MHz | FDD |
|  | | | |

* + Option 1: The first band NTN based on L-band will have the following frequency range definition: 1626.5-1660.5 MHz in UL and 1525-1559 MHz in DL.
  + Option 2: L-band 1610–1618.725MHz for UL (in combination with S-band 2483.5–2500MHz for DL)
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Fine with option 1 | It’s better to postpone the discussion since this band should rely on some inputs from irregular channel bandwidth SIDs. |
| Ericsson | Yes  With this definition, the band will be symmetric and contiguous, which is preferable for a 1st NTN band. That would facilitate requirements specification to start with. Of course, other bands with different arrangement could be proposed later. | No  This would be a mix of S-band and L-band, which was not agreed. Also, that would give an asymmetric UL/DL band with very limited frequency range (8.725 MHz in UL and 16.5 MHz in DL). |
| Samsung | No strong view on the specific frequency ranges. Generally it is depending on the requirement of the operator. But only one L-band is preferred to be captured in this R17 WI, additional bands can be introduced by separated WI. | Note the agreement of the previous RAN4 meeting in R4-2108099, the mixed paring of L-band and S-band should be considered in a separate dedicated WI. |
| **Qualcomm** | **OK with option 1** | **Suggest to postponing discussion on the mix of S-band and L-band** |
| Inmarsat | **We would like to find a way to define the full L-band (1515-1559 MHz down, 1626.5-1660.5 and 1668-1675 MHz up) while acknowledging the impracticality of the extended L-band segments in certain countries.** | We prefer option 1 upon appropriate expansion. |
| **Hughes/EchoStar** | **The range in Option 1 has not been agreed yet. We suggest considering the range proposed by L-Band satellite operators, such as Inmarsat** | **Note that agreement of the previous RAN4 meeting, the mixed paring of L-band and S-band should be considered in a separate dedicated WI.** |
| Globalstar | The resulting channel bandwidth is 34MHz, so this is another example of a need to discuss the irregular channel bandwidths in the context of NTN. | Yes. Note that it was discussed and agreed to treat this combination as a separate spectrum WI. Furthermore, it was agreed that the NTN core functionality should be forward compatible for the mixed L- and S-band combinations. Please refer to the previous agreements in R4-2108099. |

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| THALES | To further discuss and decide L-band range and different options. |  |

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| **Nokia** | | We are okay with option 1. We have a preference to keep the number of new bands to a minimum in Rel-17 to aid finalization within the allocated Rel timeframe. Additional bands can be added at a later stage. | | No – we should focus on finalizing single band operation within this WI. That said we are fine to return to this at a later stage. | |
| **Ligado** | | **Support Option 1** | | **Agree with Qualcomm.** | |
| **ESA** | | Fine with Option 1. | | Priority on Option 1. | |
| **Inmarsat** | | Inmarsat does not support progression of the work at this time in the absence of consideration of the extended L-band. | |  | |
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### Sub-topic 1-2

*Sub-topic description* NTN Band Numbering, Coding and Signalling Design

**Moderator note:** Please see RAN#99e agreements.

*Open issues and candidate options before e-meeting:*

**Issue 1-2-1:** NTN Band Coding and Signalling Design

* Proposals
  + Option 1: The same set of band coding and signaling design should be used for NTN and NR.
  + Option 2: The same set of band coding and signaling design should be used for NTN and NR. The NTN band is numbered in reverse order from the maximum NR band number in each FR.

**Table x.x-1: NR *operating bands* in FR1**

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| … | … | … | … |
| N256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| …… | | | |

* + Option 3: The NTN satellite bands should be prefixed with “s”. NTN satellite band in FR1 will have one or two digits number. The first NTN FR1 band should be named “s1”.
* Recommended WF
  + TBA.
  + **Moderator Note:** A clarification is probably required for “NTN band is numbered **in reverse order** from the maximum NR band number”.

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| ZTE | We support option 1 since we already have clear agreement in the past,  In addition, NTN band would be limited as far as we could see, it might be okay to use legacy approach | might be also fine for us. | We understand the intention to have some distinguish between NTN band and TN band, however to add s in the front the band definition, then in RAN2, additional signalling might be needed.  If to follow option1/2, then existing signalling could be reused. |
| CATT | Not prefer. Numbering NR Band and Satellite band in contiguous manner is not easy to handle due to separate specifications. | Fine with this option.  It has been agreed to use separate specifications for Satellite. Band numbering might be a little confused if we don’t have any differentiation from the number range.  If we use same set of band signaling, then this option is preferred. | If we use separate set of signaling, this option is ok. |
| Ericsson | No  That’s not required, we could introduce new band scheme with very little impact on signaling. Also, we shall not mix NTN numbering with TN one, First, NTN (BS) will have separate spec, consistence in band number will become difficult to maintain. | No  That’s not required, we could introduce new band scheme with very little impact on signaling. | Yes  It will be easy to maintain NTN bands numbering as this will be independent of the TN one. |
| **Samsung** | If the same set of band coding and signaling design is used for both NTN and NR, generally a continuous ranges of band number should be reserved for NTN. But the table in the specs may still looks strange since some band numbers are missing, especially considering separated specs for terrestrial NR and NTN (Note that the an individual spec for Satellite Node is agreed).  Not oppose to reuse the coding and signaling design, but at least, we need to consider how to split the NTN band number from 38.104 to an individual spec for NTN. | Option 2 is better than Option 1.  Refer to the comments to Option 1, | Slightly prefer Option 3  This approach seems clearer than Option 1&2 to address the operating band number for NTN especially in an individual spec. But need to check any difficulty on signaling design in RAN2 if any |

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| Xiaomi |  | Support this option, which could isolate the number from the existing TN band and maintain continuity of NTN bands | This option is also acceptable for us |

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| **Qualcomm** | **We support to use the same band coding for NR and NTN. But for option 1, it could not split NTN and NR with band number.** | **We prefer to option 2 which can split NTN and NR .** | **Not prefer. RAN2 will have to consider additional signalling that is not necessary.** |
| **Hughes/EchoStar** | **Yes, we support the same set of band coding and signaling design for NTN and NR** | **This may be confusing** | **Yes, we can consider Option 3** |

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| THALES | **Could be** |  | **Could be** |

|  |  |
| --- | --- |
| SoftBank | In RAN#89-e agreement, the WID “NR-NTN-solutions” will consider at least one example satellite band (RP-202120). And also, Service link of HAPS may use a different spectrum allocation as compared to satellites. (RP-210908, WID)  So we should call the band(s) “(NTN) satellite band”, as in Ericsson’s contribution and CATT described above. |

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| **Nokia** | No – For satellite-based NTN operation the bands should be separated from the TN bands if NTN bands are to be operated under different requirements than the corresponding TN band. | This could work assuming that you mean n256 and not N256 which then in principal is the same as option 3 | This is our preferred option. |
| Apple | Either option is fine. This is just a band number, so there is a small practical difference whether we reserve a range of numbers for the NTN bands or number them continuously with the TN bands.  One option to consider is to have a common pool of band numbers for TN and NTN bands but add the “s” prefix for the sake of clarity, if needed. As an example, n1, n2, …, s128, etc. | | No. This option does not have much practical sense because RAN2 signaling just indicates the band number, there is no prefix. So adding “s” prefix does not help in differentiating bands at least from the signaling perspective. |

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| Ligado | No | No | Yes. Support this option. |
| ESA |  |  | Preference on Option 3. |
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**Issue 1-2-2:** NTN Band Numbering

* Proposals
  + Option 1: **s1** for S-band and **s2** for L-band
  + Option 2: **n100** for S-band and **n101** for L-band
  + Option 3: **10x** for S-band
    - **Note:** this Option 3 can be included (or can be considered) as part of Option 2
  + Option 4: **n256** for S-band
  + Option 5: The NTN band should be numbered as a new band even though it is fully overlapped with a TN band.
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** | **Comments Option 4** | **Comments Option 5** |
| ZTE | Rely on the outcome of Issue 1-2-1 and suggest to postpone to 2nd round | | | | |
| Ericsson | **Yes** | No  See our comments in 1-2-1 for option 1. | No  See our comments in 1-2-1 for option 1 | No  See our comments in 1-2-1 for option 2 | Yes  There are already many TN bands overlapping, fully (e.g. n1 and n65) or not. This is common usage in RAN4.  Also, NTN band support will be managed separately from TN band management. |
| **Samsung** |  |  |  |  | **Agree** |
| **CATT** | **Same comments as issue 1-2-1** | | | | |
| **Xiaomi** | **Yes** |  |  | **Yes** | **Yes** |
| **Qualcomm** | **No** | **No** | **No** | **Yes** | **Yes** |
| **Inmarsat** | We believe it makes sense to number NTN bands prefixed with ‘s’. However we suggest where the frequency range matches an existing TN band, it may make more sense to use the same numbering | | | | |
| **Hughes/EchoStar** | **Yes** | **Yes** | **-** | **No** | **Yes** |

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| --- | --- | --- | --- | --- | --- |
| THALES | **Yes** | **Yes** |  |  | **Yes** |

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| --- | --- | --- | --- | --- | --- | --- |
| **Nokia** | **Yes** | | **No – There are already proposals to use n100 for TN FR 1 band** | **No – This range is needed for TN FR1 bands** | **Yes** | **Yes – if this is for satellite-based NTN operation** |
| **Apple** | No (see our comments above for issue 1-2-1) | | This is just a number, either way it works. | | | |
| **Ligado** | **Yes** | **No** | | **No** | **No** | **No - if identical to NR freq. ranges then same number can be used with prefix “s”** |
| **ESA** | Yes | | No | No | No | Yes |
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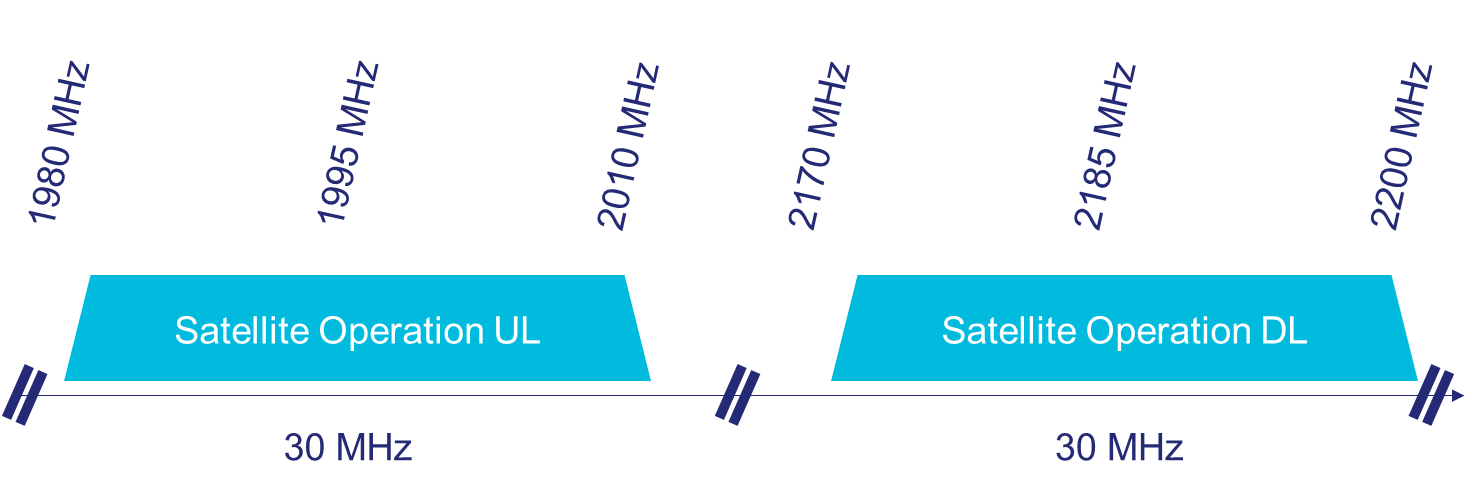
### Sub-topic 1-3

*Sub-topic description* NTN Channel BandWidth and Channel Spacing

**Moderator note:** Please see RAN#99e agreements. Option 1 and Option 2 are not clear because they seem already agreed. Please clarify if another discussion is still required.

**RAN4#99-e Agreements (R4-2108099):**

* **Proposal 2-1-2-1:** The common definition for channel bandwidth, transmission bandwidth configuration, minimum guard band, and RB alignment in 38.104 and 38.101-1 can be reused for NTN system.
* **Proposal 2-1-3-1:** The supported channel bandwidth per operating band should be defined based on NTN operator input.
* **Proposal 3-1-2-1:** RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 15 kHz: 5, 10, 15, 20 MHz.
* **Proposal 3-1-3-1:** RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 30 kHz and SCS 60 kHz: 10, 15, 20 MHz.
* **Proposal 3-1-3-2:** The supported channel bandwidth per operating band should be defined based on NTN operator input.



*Open issues and candidate options before e-meeting:*

**Issue 1-3-1:** NTN Channel BandWidth

* Proposals
  + Option 1:

| NTN Band | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| --- | --- | --- | --- | --- | --- |
|  | 15 | Yes | Yes | Yes | Yes |
| [s1] | 30 |  | Yes | Yes | Yes |
|  | 60 |  | Yes | Yes | Yes |
|  | 15 | Yes | Yes | Yes | Yes |
| [s2] | 30 |  | Yes | Yes | Yes |
|  | 60 |  | Yes | Yes | Yes |

where [s1] and [s2] ranges are defined as in

|  |  |  |  |
| --- | --- | --- | --- |
| NTN *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| [s1] | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| [s2] | 1626.5 MHz – 1660 5 MHz | 1525 MHz – 1559 MHz | FDD |

* + Option 2: The common definition for channel bandwidth, transmission bandwidth configuration, minimum guard band, and RB alignment in 38.104 and 38.101-1 can be reused for NTN system. The supported channel bandwidths need to be specified for the new NTN band.

Table x.x.x-1: *BS channel bandwidths* and SCS per *operating band* in FR1

| NR band / SCS / *BS channel bandwidth* | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz |
| … | … | … | … | … | … | … | … | … | … | … | … | … | … | … |
| [n256] | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| 30 |  | Yes | Yes | Yes |  |  |  |  |  |  |  |  |  |
| …… | | | | | | | | | | | | | | |

where [n256] range is defined as in

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| … | … | … | … |
| [n256] | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| …… | | | |

* Recommended WF
  + TBA
  + **Moderator Note:** Please note that “The common definition for channel bandwidth, transmission bandwidth configuration, minimum guard band, and RB alignment in 38.104 and 38.101-1 can be reused for NTN system.” has been agreed in RAN#99-e (see Proposal 2-1-2-1 from agreed WF R4-2108099).

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Rely on the outcome of Issue 1-2-1 and suggest to postpone to 2nd round  For minimum guard band and transmission bandwidth configuration, this should reply on the outcome of ALCR/UEM/ACS discussion. | |
| CATT |  | **Agree** |
| Ericsson | **Yes** | Except the band name (n256), this could also be acceptable. |
| **Xiaomi** | depends on the outcome of Issue 1-2-1 | |
| **Qualcomm** | **Yes but the band number should depend on the outcome of Issue 1-2-1.** |  |
| **Hughes/EchoStar** | **OK but the S2 Band range has not been finalized** | **Agree** |
| Huawei | The frequency range of L band should follow operators’ request | 60kHz SCS should be considered. |

|  |  |  |
| --- | --- | --- |
| THALES | **L-band should still be discussed, indeed.**  **However, S-band seems fine (already agreed)** | **60kHz SCS already decided in RAN#99-e and should be considered** |

|  |  |  |
| --- | --- | --- |
| **Nokia** | Yes but the band number should depend on the outcome of Issue 1-2-1. | Yes but the band number should depend on the outcome of Issue 1-2-1. |
| **Apple** | It is difficult to see the difference between Option 1 and Option 2. Nevertheless, since the S-band offers the 30MHz channel, we cannot see the reason why the 30MHz channel bandwidth should not be defined. As for all the channel bandwidths, e.g. 10, 15, 20. 30MHz, existing SU and number of RBs can be re-used. And the band number is a separate discussion issue.  As for the 60kHz SCS, the S- and L-band channels are relatively small, so we can keep 60kHz optional in the same way we do for the FR1 TN bands. | |
| **ESA** | Yes | Also fine |
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**Issue 1-3-2:** NTN Channel Spacing

**Moderator note:** Please see RAN#99e agreements.

* Proposals
  + Option 1: **Current channel spacing definition in TS 38.104 is applicable for NTN system.**

The first NTN bands (s1 and s2) would support a 100 kHz channel raster. The nominal channel spacing between two adjacent NTN carriers in those NTN bands be defined according to the following:

* + - Nominal Channel spacing = (BWChannel(1) + BWChannel(2))/2
    - where BWChannel(1) and BWChannel(2) are the *BS channel bandwidths* of the two respective NTN carriers.
* Recommended WF
  + Option 1, if agreeable.

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | Partially agree | This is only for two nominal channel spacing without considering CA, if this is only agreed, then intra-band CA case is precluded, maybe NTN WID should be further checked. |
| CATT | Agree | This depends on how many features are considered in the first release. Considering the workload, we prefer only consider single carrier. |
| Ericsson | Agree | This could be further checked but we don’t think CA should be supported in the scope of this WI. |
| Samsung | Agree |  |
| Xiaomi | Agree |  |
| Qualcomm | Agree |  |
| Hughes/EchoStar | Agree |  |
| Huawei |  | S-band has only 30MHz. CA don’t have to be considered at this stage. |
| THALES | Agree | CA is potentially for Rel-18 |
| Nokia | Agree |  |
| Apple | Agree |  |
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### Sub-topic 1-4

*Sub-topic description* NTN Raster

*Open issues and candidate options before e-meeting:*

**Issue 1-4-1:** NTN Channel Raster

* Proposals
  + Option 1: **Current channel raster defined in TS38.104 can be applied for NTN system. Channel raster entries for NTN band need to be specified.**
  + Option 2: Simplify the ARFCN values allocation for NTN, reducing the range of values,
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Fine with option 1 | Further optimization for initial access might be not needed based on our understanding. |
| Ericsson | Would be agreeable | We are open for discussion and would like to hear other companies’ view here. |
| **Qualcomm** | **Agree** | **Need discussion** |
| **Hughes/EchoStar** | **Agree** | **Need discussion** |
| Huawei | I suppose we have agreed to use 100kHz channel raster for S-band | I’d like to know why we need to simplify the NR-ARFCN. If we want to accelerate the initial access procedure, we need to reduce the search space for sync raster. |
| Globalstar | Yes | No. It is better to be flexible with channel raster points, especially for small allocations. |

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| Nokia | We agreed 100kHz channel raster for S-band – if this is what is meant we are fine to use those points from 38.104 | Similar comment as HW |

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| **Apple** | We already agreed to have the 100kHz raster points. | What is the motivation for reducing the range of values? It is not clear why we would artificially reduce it. |
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**Issue 1-4-2:** NTN Synchronization Raster

**Moderator note:** Please see RAN#99e agreements.

* Proposals
  + Option 1: **The synchronization raster entries for NTN bands need further study based on operator input.**
  + Option 2: Simplify the NR GSCN allocation, this should be aligned with the outcomes of NTN ARFCN discussion.
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Fine with option 1 | Further optimization for initial access might be not needed based on our understanding. |
| Ericsson |  | We are open for discussion and would like to hear other companies’ view here. |
| CATT | Depends on further study | Depends on further study. Prefer to reduce the GSCN if possible. |

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| Xiaomi | Ok with option 1 |  |

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| --- | --- | --- |
| **Qualcomm** | **Need further discussion** | **Need further discussion** |
| **Hughes/EchoStar** | **Agree** | **OK, need further discussion** |
| Huawei | We have agreed to reuse 100kHz channel raster. Sync raster can follow current agreement. | No. |
| Globalstar | Yes | No. It is better to be flexible with sync raster points, especially for small allocations. |

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| THALES |  |  |

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| **Nokia** | If this is for L-band then okay but for S-band it seems we have agreed the raster | We are fine to discuss this further, but could this optimization not be added as a feature in a follow up WI? |
| **Apple** | Yes as a baseline | What does simplification mean? |
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**Issue 1-4-3:** NTN ARFCN and GSCN

**Moderator Note:**

* Proposals
  + Option 1:

Table x.x.x.x-1: Applicable NR-ARFCN per *operating band* in FR1

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | ΔFRaster  (kHz) | Uplink  range of NREF  (First – <Step size> – Last) | Downlink  range of NREF  (First – <Step size> – Last) |
| … | … | … | … |
| [n256] | 100 | 396000 – <20> – 402000 | 434000 – <20> – 440000 |
| …… | | | |

Table x.x.x.x-1: Applicable SS raster entries per *operating band* (FR1)

|  |  |  |  |
| --- | --- | --- | --- |
| NR *operating band* | SS Block SCS | SS Block pattern (NOTE 1) | Range of GSCN  (First – <Step size> – Last) |
| … | … | ... | … |
| [n256x] | 15 kHz | Case A | 5429 – <1> – 5494 |

|  |
| --- |
| NOTE x: The following GSCN are allowed for operation in band n256:  GSCN = {a1, a2, …}. |

* + Option 2: **Further study if NTN ARFCN and GSCN should be simplified, reducing the range of values.**
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Rely on the outcome of Issue 1-2-1, 1-4-1, 1-4-2 and suggest to postpone to 2nd round | |
| Ericsson | Except the band name (n256), this could be acceptable if no simplification is expected by anyone (option 2).  Also, the 1st GSCN for the band should be 5419? | We are open for discussion and would like to hear other companies’ view here. |
| **Qualcomm** | **In general, we are OK with option 1** |  |
| **Hughes/EchoStar** | **In general OK but not fond of the band number (n256)** |  |
| Globalstar | This option is Ok as a principle. | No. What is the motivation for “simplification” and reducing the available range? |

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| THALES |  |  |
| Nokia | This is okay but naming is still open | See comment for Issue 1-4-2 option 2 |

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| **Apple** | Ok | The motivation for reducing the range is not clear. |
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## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #2: NTN gNB Class/Type

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2112009](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112009.zip) | CATT | **Proposal 1: It is proposed to define type 1-C and type 1-H requirements for NTN BS in Rel-17 and use the figure 2-1 and 2-2 as the reference architecture.**    2-1 NTN BS type 1-C reference interface    2-2 NTN BS type 1-H reference interface  **Proposal 2: It is proposed to introduce 3 NTN BS types,**   * + - **NTN BS class A representing a typical operating altitude of 35786/50000 km**     - **NTN BS class B representing a typical operating altitude in the range of 7000-25000 km**     - **NTN BS class C representing a typical operating altitude in the range of 300-1500 km** |
| [R4-2113184](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113184.zip) | CMCC | **Observation 1: it seems NTN gNB could be classified by different altitudes or altitude ranges to differentiate RF requirements.**  **Proposal 1: NTN gNB classes are characterised by requirements derived from different satellite types with certain satellite to ground altitude or altitude range.**  **Proposal 2: for S band, all the 1-C, 1-H, 1-O types are suggested for NTN network.** |
| [R4-2113929](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113929.zip) | ZTE Corporation | **Proposal 1**: BS type 1-H or BS type 1-O could be defined for NTN BS.    Figure 2. reflector antenna architecture with beam port/[RF connector]    Figure 3. Lens antenna architecture with beam port/[RF connector]    Figure 4. antenna array architecture with beam port/[RF connector]  **Proposal 2**: to define GEO/LEO-600KM/LEO-1200KM NTN BS with the criteria of NTN BS height. |
| [R4-2113744](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113744.zip) | Ericsson | **Proposal1: NTN BS would only specify BS types 1-H and 1-O, not BS type 1-C.**  **Proposal2: Define NTN BS class based (at least) on the considered satellite’s orbit.**  **Proposal3: Further discuss if, for each of those NTN BS classes, additional sub-classes should be considered.** |

## Open issues summary

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

### Sub-topic 2-1

*Sub-topic description:* Satellite NTN gNB Type

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1:** Satellite NTN gNB Type

* Proposals
  + Option 1: 1-H (already decided during RAN4#99-e)
  + Option 2: 1-H (already decided during RAN4#99-e) and 1-O
    - Note: **NTN BS would only specify BS types 1-H and 1-O, not BS type 1-C.**
  + Option 3: 1-H (already decided during RAN4#99-e) and 1-C
    - Note: **It is proposed to define type 1-C and type 1-H requirements for NTN BS in Rel-17 and use the figure 2-1 and 2-2 as the reference architecture.**



2-1 NTN BS type 1-C reference interface



2-2 NTN BS type 1-H reference interface

* + Option 4: 1-H (already decided during RAN4#99-e) and 1-O and 1-C
    - Note: **for S band, all the 1-C, 1-H, 1-O types are suggested for NTN network.**
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** | **Comments Option 4** |
| ZTE |  | Support the option 2,  If BS type 1-C is also supported, then how to generate the multiple beams for GEO/LEO should be clarified |  |  |
| Ericsson | Yes  Already agreed. | Yes  Already agreed, 1-O could be done in a later phase or not. | No  To our understanding, introducing type 1-C for NTN would violate the BS type concept: we don’t think satellite will embed passive antenna.  One contribution was suggesting 1-C could be considered for R&D investigation, but 3GPP specifications are not needed for this. | No  For the same reasons given in option 3, 1-C shall be not be introduced. |
| CATT | Type 1-H is in the scope. 1-O has be excluded in the last RAN4 meeting. the left question is whether to include 1-C as well. Either option 1 or option 3 is ok for us. | | | |

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| THALES |  |  |  |  |

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| **Nokia** | **Yes** | **Yes** | **No** | | **No** |
| **Ligado** | **Yes** |  | **Yes** |  | |
| **Huawei** | While the 1-C does not seem to be the best application for the NTN, there were some view in [314] indicating that 1-C may be useful to consider. We would like to further investigate that option and keep 1-C FFS for one more meeting. | | | | |
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### Sub-topic 2-2

*Sub-topic description:* Satellite NTN gNB Type

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1:** Satellite NTN gNB Class - general

* Proposals
  + Option 1: Introduce 3 NTN BS classes,
    - NTN BS class A representing a typical operating altitude of 35786/50000 km
    - NTN BS class B representing a typical operating altitude in the range of 7000-25000 km
    - NTN BS class C representing a typical operating altitude in the range of 300-1500 km
* Recommended WF
  + Further clarify the purpose/the need of introducing different NTN BS classes. The classification may depend on many parameters including satellite (maximum) transmission power, which should not be limited.

**Please provide your opinions/comments with respect to Option 1.**

|  |  |
| --- | --- |
| **Company** | **Comments Option 1** |
| ZTE | We prefer to use GEO/LEO to distinguish the deployment scenarios, in addition, NTN BS with 50000 km is out of NTN coexistence study. |
| Ericsson | We would most likely need different BS classes, each class having a different set of limits. The altitude approach sounds logical but it might not be enough as highlighted in our contribution (2 different sets of satellite parameters have already been mentioned in TR 38.821). Also, the proposed class B seems not relevant in this NTN WI scope: there is no coexistence scenario for such satellite, no requirement will be specified for this class B then…  The most pragmatic approach might be to consider there will be different NTN BS class to start with and then, when after RAN4 has specified all limits, RAN4 could evaluate again if there is really a need for NTN BS class. |
| CATT | Option 1 is just a illustration on requirement structure. The altitude is related to the output power closely. It’s obvious that different type of satellite will operating in different altitude corresponding to different output power. |
| **Hughes/EchoStar** | **Support recommended WF** |
| Huawei | I’m not sure we have to differentiate the satellite gNB class in Rel-17. Referring to the assumption for coexistence, the Satellite max TX power for GEO, LEO-1200 and LEO-600 is very close (All the values of Tx power are larger than 40dBm). I would like to know whether the RF requirements or product form will be very different with few max Tx power. The mainly difference for GEO and LEO is the antenna gain. However, if we don’t consider OTA requirements at this stage, there is no need to differentiate the satellite gNB class.  Besides, we only specify the WA class in Rel-8 for LTE. We can follow it and extend the other class in later release. I don’t think we can specify three different satellite gNB class before REl-17 is frozen. |

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| THALES |  |

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| Nokia | Different BS classes might be needed dependent on Tx power and coverage area. If they are to be separated, then Max output power and altitude under operation could be a starting point. |
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**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | **partially** | Regarding the NTN output power should be limited or not, this depends on how NTN network is deployed. If GEO and LEO could operate at the same frequency, then whether some power limitation for LEO is needed? This kind of deployment scenario maybe need to be clarified by operators.  In addition, this is also very important for RAN2 measurement or RAN4 measurement gap design. |
| Hughes/EchoStar | agree |  |
| Huawei |  | We echo moderator’s comments. The proponent can clarify why we need to introduce different NTN BS classes |
| THALES |  |  |
| Nokia | Partially | We do not understand the statement that “(maximum) transmission power should not be limited.” |
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**Issue 2-2-2:** Criteria for defining NTN gNB Class

* Proposals
  + Option 1: Define NTN BS class based (at least) on the considered **satellite’s orbit.**
    - **Note:** Further discuss if, for each of those NTN BS classes, additional sub-classes should be considered.
  + Option 2: Define NTN gNB classes characterised by requirements derived from different satellite types with certain satellite to ground **altitude or altitude range.**
    - **Note:** NTN gNB could be classified by different altitudes or altitude ranges to differentiate RF requirements.
* Recommended WF
  + Clarify the purpose of defining NTN BS classes and the benefit of introducing such classification. The classification may depend on many parameters including satellite (maximum) transmission power, which should not be limited.

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | We prefer to use GEO/LEO to distinguish the deployment scenarios, in addition, NTN BS with 50000 km is out of NTN coexistence study. | |
| Ericsson | Yes, this is proposal, further discussion would needed to clarify class definition more precisely | This is aligned with our proposal but additional criteria might be needed (or not). |
| **CATT** | **We should clarify what exactly orbit. In our understanding, there are a lot of orbits related to a specific constellation. However, we only need to specify a single BS class for a constellation.** | **Yes.** |
| Huawei | I suppose BS class depends on the requirements and product form. Referring to the assumption for coexistence, the Satellite max TX power for GEO, LEO-1200 and LEO-600 is very close (All the values of Tx power are larger than 40dBm). I think it’s premature to define different satellite gNB class since the demands/scenario/product form are unclear. | |

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| THALES |  |  |

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| Nokia | Maybe it is to unclear to use orbit here. | Yes this could be used but it should be emphasized that it is altitude under operation which is meant. This accounts for different types of orbit. |
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**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | **partially** | Regarding the NTN output power should be limited or not, this depends on how NTN network is deployed. If GEO and LEO could operate at the same frequency, then whether some power limitation for LEO is needed? This kind of deployment scenario maybe need to be clarified by operators.  In addition, this is also very important for RAN2 measurement or RAN4 measurement gap design. |
| Hughes/EchoStar | agree |  |
| Huawei |  | We echo moderator’s comments. The proponent can clarify why we need to introduce different NTN BS classes |
| THALES |  |  |
| Nokia | Partially | We do not understand the statement that “(maximum) transmission power should not be limited.” |
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## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

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| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: General Band Related Parameters

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2112390](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112390.zip)  and  [R4-2112391](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112391.zip) | GLOBALSTAR Inc. | Table 1: Regulatory parameters of the L-band and S-band   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Band** | **Frequencies (MHz)** | **Direction** | **Total BW (MHz)** | **Regions** | | **L-band** | 1518-1559 | Space to Earth (DL) | 41MHz (DL) | 1, 2, 3 | | 1610-1613.8 | Earth to Space (UL) | 3.8MHz (UL) | | 1613.8-1626.5 | Earth to Space (UL)  Space to Earth (DL) | 12.7MHz (UL/DL) | | 1626.5-1660.5 | Earth to Space (UL) | 34MHz (UL) | | 1668-1668.4 | Earth to Space (UL) | 7MHz (UL) | | 1668.4-1670 | Earth to Space (UL) | | 1670-1675 | Earth to Space (UL) | |  |  |  |  |  | | **S-band** | 1980-2010 | Earth to Space (UL) | 30MHz (UL) | 1, 2, 3 | | 2010-2025 | Earth to Space (UL) | 15MHz (UL) | 2 | | 2160-2170 | Space to Earth (DL) | 10MHz (DL) | 2 | | 2170-2200 | Space to Earth (DL) | 30MHz (DL) | 1, 2, 3 | | 2483.5-2500 | Space to Earth (DL) | 16.5MHz (DL) | 1, 2, 3 | | 2500-2520 | Space to Earth (DL) | 20MHz (DL) | 3 | | 2670-2690 | Earth to Space (UL) | 20MHz (UL) | 3 |   **Observation 1:** While most of the S-band satellite allocations match NR standard channel bandwidths, there are allocations on the S-band, and especially on the L-band, size of which is "irregular".  **Observation 2:** Using next smaller NR standard channel will result in quite noticeable resource wastage.  **Observation 3:** 3GPP has an ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths" where solutions for irregular channel bandwidths are considered.  **Proposal 1:** We ask 3GPP to consider NTN irregular channel bandwidths in the context of the ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths".  **Proposal 2:** As an operator request, we ask to consider irregular channel bandwidths from L-band (1610–1618.725MHz) and S-band (2483.5–2500MHz) spectrum allocations. |
| [R4-2113928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113928.zip) | ZTE Corporation | **Proposal 2**: to postpone the SU discussion until there are clear agreement for out-of-band emission requirement and in-band emission requirements defined for NTN;  **Proposal 3**: for NTN S band, the following system parameters should be adopted.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR operating band | UL [MHz] | | DL [MHz] | | Duplexer | Fglobal [KHz] | channel raster [KHz] | UL NREF | | DL NREF | | SSB Block SCS [KHz] | SSB Pattern | GSCN\_L | GSCN\_H | | [10x] ? | 1980 | 2010 | 2170 | 2200 | FDD | 5 | 100 | 396000 | 402000 | 434000 | 440000 | 15 | Case A | 5429 | 5494 | |
| [R4-2113741](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113741.zip) | Ericsson | **Proposal1: The first band NTN based on L-band will have the following frequency range definition: 1626.5-1660.5 MHz in UL and 1525-1559 MHz in DL.**  **Proposal2: Add a note to the definition of the new band s1 ([4]) mentioning that: “Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision)”.** |
|  |  |  |
|  |  |  |

## Open issues summary

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

### Sub-topic 3-1

*Sub-topic description:* Irregular Channel BW

*Open issues and candidate options before e-meeting:*

**Issue 3-1-1:** Irregular Channel BW - general

* Proposals
  + Option 1: We ask 3GPP to consider NTN irregular channel bandwidths in the context of the ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths".

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| Note : Table 1: Regulatory parameters of the L-band and S-band   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Band** | **Frequencies (MHz)** | **Direction** | **Total BW (MHz)** | **Regions** | | **L-band** | 1518-1559 | Space to Earth (DL) | 41MHz (DL) | 1, 2, 3 | | 1610-1613.8 | Earth to Space (UL) | 3.8MHz (UL) | | 1613.8-1626.5 | Earth to Space (UL)  Space to Earth (DL) | 12.7MHz (UL/DL) | | 1626.5-1660.5 | Earth to Space (UL) | 34MHz (UL) | | 1668-1668.4 | Earth to Space (UL) | 7MHz (UL) | | 1668.4-1670 | Earth to Space (UL) | | 1670-1675 | Earth to Space (UL) | |  |  |  |  |  | | **S-band** | 1980-2010 | Earth to Space (UL) | 30MHz (UL) | 1, 2, 3 | | 2010-2025 | Earth to Space (UL) | 15MHz (UL) | 2 | | 2160-2170 | Space to Earth (DL) | 10MHz (DL) | 2 | | 2170-2200 | Space to Earth (DL) | 30MHz (DL) | 1, 2, 3 | | 2483.5-2500 | Space to Earth (DL) | 16.5MHz (DL) | 1, 2, 3 | | 2500-2520 | Space to Earth (DL) | 20MHz (DL) | 3 | | 2670-2690 | Earth to Space (UL) | 20MHz (UL) | 3 | |

* Recommended WF
  + TBA

**Please provide your opinions/comments with respect to Option 1.**

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| --- | --- |
| **Company** | **Comments Option 1** |
| ZTE | It could be checked in the corresponding SID if necessary, however we need to complete this WID in time. |
| Ericsson | Disagree  Irregular BW is a Rel-17 SI which is currently on-going with an agreed scope. This SI has not considered NTN so far so, to not delay the SI nor NTN WI, we propose to address this in another SI or WI dedicated to NTN . Anyway, it’s not up to RAN4 to decide on modifying any SI/WI’ scope, this shall be addressed in RAN. |
| **CATT** | **This may make the situation a lillte complex.** |
| **Qualcomm** | **Disagree. It will delay NTN WI progress.** |
| **Hughes/EchoStar** | **Disagree. This can be proposed after S band in NTN WI is complete** |
| **Huawei** | Disagree. The irregular channel BW for TN is still under discussion at SI stage. We can’t extend the discussion to NTN at this stage. |
| Globalstar | Our intention is to raise the point that many satellite bands are irregular. Whatever solutions 3GPP has been developing should be ideally applicable to both TN and NTN bands. Otherwise, the Rel-17 NTN core functionality will not be able to support certain L- and S-bands. |

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| THALES |  |

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| **Nokia** | Disagree – we are already behind with the NTN WI so opening up a parallel discussion in another ongoing SI/WI would just stall progress for NTN even further. This topic can be considered in a follow up WI after the ongoing have finalized. |
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**Issue 3-1-2:** Irregular Channel BW allocation from L-Band and S-band

* Proposals
  + Option 1: As an operator request, we ask to consider irregular channel bandwidths from L-band (1610–1618.725MHz) and S-band (2483.5–2500MHz) spectrum allocations
* Recommended WF
  + TBA

**Please provide your opinions/comments with respect to Option 1.**

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| **Company** | **Comments Option 1** |
| ZTE | Rely on the output of other SID and maybe we could postpone this discussion in this thread |

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| Ericsson | Disagree  See comments above on issue 3-1-1 |

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| **Qualcomm** | **Disagree. It will delay NTN WI progress.** |
| **Hughes/EchoStar** | **Can be done after NTN WI complete** |
| Huawei | Disagree. Postpone this proposal in Rel-17. |
| Globalstar | Our intention is to raise the point that there are satellite bands that have irregular channel bandwidths, and we would welcome if ongoing SI on irregular channels can account for potential NTN irregular channels. We propose that solutions, which are determined by the irregular CBW study, will be feasible and applicable to the anticipated mixed L/S band plan. |

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| THALES |  |

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| Nokia | Disagree, see comments for Issue 3-1-1 |
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### Sub-topic 3-2

*Sub-topic description:* SU Discussion

*Open issues and candidate options before e-meeting:*

**Issue 3-2-1:** SU Discussion

* Proposals
  + Option 1: **postpone the SU discussion** until there are clear agreement for out-of-band emission requirement and in-band emission requirements defined for NTN;
  + Option 2: **Do not postpone the SU discussion (**until there are clear agreement for out-of-band emission requirement and in-band emission requirements defined for NTN**);**
* Recommended WF
  + It would be useful to clarify the proposal from Option 1, e.g. how it relates to Issue 1-3-1.

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | We support option 1 based how to define SU in Rel-15 |  |
| Ericsson | No  The out of band and in-band discussions could be done considering the agreed SU, no need to differ this.  Moreover, for FR1, UEs should most likely support the SU agreed for TN. | Agree  For the reasons given previously for option1 |
| **CATT** | **We think the SU could be reused.** | |
| **Qualcomm** |  | **We prefer to reuse the SU until issues are identified.** |
| Huawei | We support option 1. We can’t make a decision since out-of-band emission requirement and in-band emission requirements are unclear. |  |

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| THALES |  |  |

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| Nokia | If SU are reused from TN operation, then no need to postpone. This would also give a guideline for further discussion on out/in-band emission requirements. | |
| **Apple** | This issue overlaps with 1-3-1. If we agree that we plan/will re-use existing channel bandwidths with number of RBs, then it is not clear what this issue aims at. | |
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**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

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| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE |  | Candidate BW and SCS is clear from Issue 1-3-1, however the transmission bandwidth configuration should depend on the coexistence study. |
| THALES |  |  |
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### Sub-topic 3-3

*Sub-topic description:* ITU Recommendation for S-Band

*Open issues and candidate options before e-meeting:*

**Issue 3-3-1:** ITU Recommendation for S-Band

* Proposals
  + Option 1: Add a note to the definition of the **new band [s1]** ([R4-2113745](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113745.zip)) mentioning that: **“Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision)”.**
    - **Moderator Note:** [s1] refers to the S-band as described below:

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| --- | --- | --- | --- |
| NTN *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode |
| [s1]1 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| [s2] | 1626.5 MHz – 1660 5 MHz | 1525 MHz – 1559 MHz | FDD |
| NOTE 1: Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision) | | | |

* Recommended WF
  + TBA

**Please provide your opinions/comments with respect to Option 1.**

|  |  |
| --- | --- |
| **Company** | **Comments Option 1** |
| ZTE | Not preferred since this will introduce additional RAN2 signalling. |
| Ericsson | Yes.  We think this is important note for coexistence, pointing to ITU Recommendation and Resolution.  To ZTE: what additional signalling is expected when introducing this note? |
| Samsung | The coexistence study is under development and leading by email thread [313]. The relevant ITU-R regulation (Radio Regulation, Rec, Resolution etc.) definitely should be followed, but it is necessary to develop some analysis firstly and captured into the specific chapter of TR 38.863, and then reflected into the TS with appropriate manner if necessary.  Note that the Rec. M.1036-6 is still under discussion in WP5D, even though the contents relevant to NTN FR1 bands are stable.  Therefore, the proposed text in Note 1 should be further discussed and revised as appropriate. |
| **Qualcomm** | **Disagree. We are doing the co-ex in RAN4. No need to add the note 1.** |
| **Hughes/EchoStar** | **Disagree. Concur with Qualcomm** |
| Huawei | Need time to further check the proposal. |

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| THALES |  |

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| Nokia | Similar comment as Samsung – we need to discuss this further and perhaps also consider if similar considerations/references are needed for [s2] |
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## Companies views’ collection for 1st round

### Open issues

**Example 1**

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| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #4: New NTN TR and TS Titles and Scope

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2114471](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114471.zip) | THALES | **Proposal 1.** RAN4 to discuss with respect to the new NTN specification titles and eventually to clarify if any concerns with respect to their scope.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | | | Proposed Spec no. or series | Type | Title | For info  at TSG# | For approval at TSG# | Remarks | | *38.863* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Core part;* | | *38.108* | *TS* | **NR; Satellite Node radio transmission and reception** | 94-e | 95 | *Core part;* | | *38.181* | *TS* | **NR; Satellite Node conformance testing** | 96 | 97 | *Performance part;* | |
| [R4-2113430](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113430.zip) | Huawei, HiSilicon | **Observation 1: the “satellite node” defined in the revised WID doesn’t accurately reflect what was agreed in RAN4 and it doesn’t accurately match the assumption of transparent payload.**  **Observation 2: Ka band will be discussed after Rel-17, but neither TS 38.101-1 nor TS 38.101-2 is suitable to specify Ka band’s UE RF requirements.**  **Proposal 1: create a new TS for satellite UE RF requirements.**  **Proposal 2: send RAN plenary a LS to recommend revising the new specifications in NR NTN WID as in table 2.**  Table 2 Revision of new specifications as proposed   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | | | Proposed Spec no. or series | Type (see note 1) | Title | For info  at TSG# | For approval at TSG# | Remarks | | *38.8XX* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Led by RAN4, rapporteur: Yiran Jin,* [*yiran.jin@samsung.com*](mailto:yiran.jin@samsung.com)  *Core part;* | | *38.1XX* | *TS* | **NR; Satellite Communication System radio transmission and reception: Access network part** | 94-e | 95 | *Led by RAN4, rapporteur: Dorin Panaitopol,* [*dorin.panaitopol@thalesgroup.com*](mailto:dorin.panaitopol@thalesgroup.com)  *Core part;* | | *38.1XX* | *TS* | NR; Satellite Communication System radio transmission and reception: User Equipment (UE) part | 94-e | 95 | *Led by RAN4, rapporteur: Peng Zhang zhangpeng169@huawei.com*  *Core part;* | | *38.1XX* | *TS* | **NR; Satellite Communication System conformance testing:**  **Access network part** | 96 | 97 | *Led by RAN4, rapporteur: Yuexia Song,* [*songyuexia@datangmobile.cn*](mailto:songyuexia@datangmobile.cn)  *Performance part;* | |
| [R4-2113450](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113450.zip) | CATT | **Proposal 1: Change the new NTN specification to the following names and introduce abbreviation later in the spec for S-gNB.**   * + - **《Satellite Base Station (S-BS) radio transmission and reception》**     - **《Satellite Base Station (S-BS) conformance testing》**   **Proposal 2: Send a LS to RAN3 and telling them to replace the gNB with S-gNB in the architecture figure.**    **Figure 2-1 NTN architecture** |
| [R4-2113451](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113451.zip) | CATT | **To RAN WG~~2~~3**  **ACTION:** RAN4 respectfully asks RAN3 to consider whether the above RAN4 finding is correct and consider it in the future work if reasonable. |
| [R4-2112517](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112517.zip) | Samsung | **Proposed contents TR 38.863**  Foreword 4  Introduction 5  1 Scope 6  2 References 6  3 Definitions of terms, symbols and abbreviations 6  3.1 Terms 6  3.2 Symbols 6  3.3 Abbreviations 7  4 General aspects 7  4.1 Work item objective 7  4.2 Reference points for RF requirements 7  5 Co-existence study 7  5.1 Co-existence simulation scenario 7  5.2 Co-existence simulation assumption 7  5.3 Co-existence simulation methodology 7  5.4 Co-existence simulation results 7  5.5 Summary of co-existence study 7  6 RF requirements 8  6.1 Common issues for satellite node and NTN UE 8  6.1.1 Operating bands and channel arrangements 8  6.1.2 Channel bandwidth, SCS and spectral utilization 8  6.1.3 Channel raster and sync raster 8  6.2 Satellite communication system requirements: Access Network Part 8  6.2.1 General 8  6.2.1.1 Satellite node class 8  6.2.2 Transmission characteristics 8  6.2.3 Receiver characteristics 8  6.2.4 Others 8  6.3 NTN UE requirements 8  6.3.1 General 8  6.3.2 NTN UE transmission characteristics 8  6.3.3 NTN UE receiver characteristics 8  6.3.4 Others 9  7 Regulatory aspects 9  7.1 ITU-R 9  Annex A: Simulation results of NTN components 10  Annex B: Simulation results of TN components 11  Annex C: To be added. 12  Annex D: Change history 13 |
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## Open issues summary

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

### Sub-topic 4-1

*Sub-topic description:* Titles and Scope of NTN NR TR and TS

*Open issues and candidate options before e-meeting:*

**Issue 4-1-1:** Titles and Scope of NTN NR TR and TS - **general**

* Proposals
  + Option 1: RAN4 to discuss with respect to the new NTN specification titles and eventually to clarify if any concerns with respect to their scope.

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| **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | |
| Proposed Spec no. or series | Type | Title | For info  at TSG# | For approval at TSG# | Remarks |
| *38.863* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Core part;* |
| *38.108* | *TS* | **NR; Satellite Node radio transmission and reception** | 94-e | 95 | *Core part;* |
| *38.181* | *TS* | **NR; Satellite Node conformance testing** | 96 | 97 | *Performance part;* |

* Recommended WF
  + Option 1, if agreeable.

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

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| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | partially, | For conformance testing part, if 1-O is also approved, the one radiated spec should be specified similar as 38.141-2 for NR BS or 38.176-2 for IAB. |
| CATT |  | We think RAN4 should decide this topic as soon as possible because it is closely related to how to define the requirement and the architecture. No further delay is expected. |
| Ericsson | Agree | We shall define precisely what “satellite node“ means, but those titles are short and would be self-explicit to everyone once this “satellite node” definition would have been clarified. |
| Qualcomm | Agree |  |
| Huawei | partially | We still need to create a new UE specification. The term “satellite node” should wait for the outcome of issue 4-1-3 |
| THALES |  |  |
| Nokia | Agree | It is important that “satellite node“ is defined. We have a preference for the naming proposed in [R4-2113430](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113430.zip" \t "_blank) which avoid the “node”. |
| ESA | Agree |  |
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**Issue 4-1-2:** Title and Scope of NTN NR TR 38.863

* Proposals
  + Option 1: NTN related RF and co-existence aspects
* Recommended WF
  + Option 1, if agreeable.

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| ZTE | agree |  |
| Ericsson | Agree |  |
| Samsung |  | Following the guideline of MCC, the full name of NTN should be spelt out in the title which should be as ‘Non-terrestrial networks (NTN) related RF and co-existence aspect’. |
| Qualcomm | Agree |  |
| THALES |  |  |
| Nokia | Agree | Also with the update proposed by Samsung |
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**Issue 4-1-3:** Title and Scope of NTN NR TS 38.108

* Proposals
  + Option 1: NR; **Satellite Node radio transmission and reception**
  + Option 2: NR; **Satellite Communication System radio transmission and reception: Access network part**
  + Option 3: NR; **Satellite Base Station (S-BS) radio transmission and reception**
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| ZTE | Option 1 |  |  |
| Ericsson | **Yes**  We shall define precisely what “satellite node“ means, but those titles are short and would be self-explicit to everyone once this “satellite node” definition would have been clarified. | No  “Access network part” is very unclear. Also, “satellite communication system” would need further clarification. | No  With such naming, it’s ambiguous if a TN BS would actually be embedded in the satellite. This would be confusing. |
| **CATT** | **We should precisely define the term whatever we choose. It’s clear that what we are specifying requirement for is not satellite node. It is the payload carried on the satellite.**  **To Ericsson, Option3 can avoid confusing by define a clear reference atchitecture in 38.108. e.g. what is included in the satellite BS, including NTN-pyaload+NTG Gateway+…”** | | |
| **Hughes/EchoStar** |  | **Option 2 with modification: NR; Satellite Communication System radio “access” transmission and reception: ~~Access network part~~** |  |
| Huawei | No, transparent satellite payload is assumed in Rel-17. In the future release, regenerated satellite payload will be proposed. For these two cases, satellite node may cause some confusion.  Satellite node seems not to align with what we agreed. | Yes. Access network part is used in CR coversheet. It’s very clear in 3GPP. We should precisely define the term. | No |

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| THALES |  |  |  |

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| Nokia | OK – if “satellite node” is defined | Preferred | No |
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**Issue 4-1-4:** Title and Scope of NTN NR TS 38.181

* Proposals
  + Option 1: NR; **Satellite Node** conformance testing
  + Option 2: NR; **Satellite Communication System** conformance testing: Access network part
  + Option 3: NR; **Satellite Base Station (S-BS) conformance testing**
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| ZTE | **Option 1** |  |  |
| Ericsson | Yes  With comments given in 4-1-3 | No  For the reasons given in 4-1-3 | No  For the reasons given in 4-1-3 |
| **CATT** | **Would say no for the time being. Since satellite node is confusing.** | **no** | **Yes** |
| Huawei | No, transparent satellite payload is assumed in Rel-17. In the future release, regenerated satellite payload will be proposed. For these two cases, satellite node may cause some confusion.  Satellite node seems not to align with what we agreed. | Yes. Access network part is used in CR coversheet. It’s very clear in 3GPP. We should precisely define the term. | No |

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| THALES |  |  |  |

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| Nokia | OK – if “satellite node” is defined | Preferred | No |
| CATT |  |  | There was an offline proposal to me to change option 3 to “Sat-BS” maybe companies can check whether this one works. |
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### Sub-topic 4-2

*Sub-topic description:* Table of Contents for NTN NR TR 38.863

*Open issues and candidate options before e-meeting:*

**Issue 4-2-1:** Table of Contents for NTN NR TR 38.863

* Proposals
  + Option 1: **Agree** the **Table of Contents of TR 38.863**
  + Option 2: **Propose changes** for the current **Table of Contents of TR 38.863**

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| **Proposed contents TR 38.863**  Foreword 4  Introduction 5  1 Scope 6  2 References 6  3 Definitions of terms, symbols and abbreviations 6  3.1 Terms 6  3.2 Symbols 6  3.3 Abbreviations 7  4 General aspects 7  4.1 Work item objective 7  4.2 Reference points for RF requirements 7  5 Co-existence study 7  5.1 Co-existence simulation scenario 7  5.2 Co-existence simulation assumption 7  5.3 Co-existence simulation methodology 7  5.4 Co-existence simulation results 7  5.5 Summary of co-existence study 7  6 RF requirements 8  6.1 Common issues for satellite node and NTN UE 8  6.1.1 Operating bands and channel arrangements 8  6.1.2 Channel bandwidth, SCS and spectral utilization 8  6.1.3 Channel raster and sync raster 8  6.2 Satellite communication system requirements: Access Network Part 8  6.2.1 General 8  6.2.1.1 Satellite node class 8  6.2.2 Transmission characteristics 8  6.2.3 Receiver characteristics 8  6.2.4 Others 8  6.3 NTN UE requirements 8  6.3.1 General 8  6.3.2 NTN UE transmission characteristics 8  6.3.3 NTN UE receiver characteristics 8  6.3.4 Others 9  7 Regulatory aspects 9  7.1 ITU-R 9  Annex A: Simulation results of NTN components 10  Annex B: Simulation results of TN components 11  Annex C: To be added. 12  Annex D: Change history 13 |

* + Recommended WF
    - TBA
    - If further changes are proposed, please specify them.

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| Ericsson | **No** | Yes  Move regulatory aspects to section 5  RF reference points (4.2) should be moved to 6.1 or 6.2.2  Title of 6.2 is ambiguous: Satellite communication system requirements: Access Network Part, should relate to "satellite node" (6.2.1.1 is named “satellite node class”) |

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| CATT | **Open for further discussion.** |

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| Huawei | Need more discussion. | |
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### Sub-topic 4-3

*Sub-topic description:* Introduction of New Specific UE TS for UE NTN NR

*Open issues and candidate options before e-meeting:*

**Issue 4-3-1:** Introduction of New Specific UE TS for UE NTN NR

* Proposals
  + Option 1: Introduce new specification 38.1xx for NR; Satellite Communication System radio transmission and reception: User Equipment (UE) part
    - Note: Option 1 seems applicable to both FR1 and potentially FR2
  + Option 2: At least in FR1,the NTN UE is not requiring a different specification from TS 38.101-1.
    - Note: If NTN UE requirements are different from TN UE requirements, NTN UE specific requirements can be included in a dedicated section.
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE | Fine with option 1 |  |



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| Ericsson | We could accept this option, but this TS title might be updated and the NTN WI as well to include this new TS. |  |
| **Samsung** | **Fine with option 1** |  |
| **CATT** | **Fine this this option.** |  |
| **Qualcomm** | **No. We don’t see the need to have a separate specification for NTN UE since it can be specified with new suffix.** | **OK with option 2. We can further discuss for FR2 in future.** |
| Ericsson | After further thinking, this option 1 is our preference: TS 38.101-1 is already a huge specification (even difficult to just open it…). Introducing NTN would just make the specs even more complicated.  And instead of having a new number TS 38.1xx, we propose to use number TS 38.101-5 for NTN NR UE and link it to NR UE series. |  |
| Huawei | Yes | No, that may result that we can’t find a suitable spec for Ka band considering future. |

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| THALES |  |  |

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| **Nokia** | We are okay with this |  |
| **ESA** | Yes | Also fine with Option 2 (baseline for FR1) |
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### Sub-topic 4-4

*Sub-topic description:* LS to other groups

*Open issues and candidate options before e-meeting:*

**Issue 4-4-1:** LS to RAN-P

* Proposals
  + Option 1: send RAN plenary a LS to recommend revising the new specifications in NR NTN WID as in table 2.

Table 2 Revision of new specifications as proposed

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Proposed Spec no. or series | Type (see note 1) | Title | For info  at TSG# | For approval at TSG# | Remarks |
| *38.8XX* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Led by RAN4, rapporteur: Yiran Jin,* [*yiran.jin@samsung.com*](mailto:yiran.jin@samsung.com)  *Core part;* |
| *38.1XX* | *TS* | **NR; Satellite Communication System radio transmission and reception: Access network part** | 94-e | 95 | *Led by RAN4, rapporteur: Dorin Panaitopol,* [*dorin.panaitopol@thalesgroup.com*](mailto:dorin.panaitopol@thalesgroup.com)  *Core part;* |
| *38.1XX* | *TS* | NR; Satellite Communication System radio transmission and reception: User Equipment (UE) part | 94-e | 95 | *Led by RAN4, rapporteur: Peng Zhang* [*zhangpeng169@huawei.com*](mailto:zhangpeng169@huawei.com)  *Core part;* |
| *38.1XX* | *TS* | **NR; Satellite Communication System conformance testing:**  **Access network part** | 96 | 97 | *Led by RAN4, rapporteur: Yuexia Song,* [*songyuexia@datangmobile.cn*](mailto:songyuexia@datangmobile.cn)  *Performance part;* |

* Recommended WF
  + TBA

**Please provide your opinions/comments with respect to Option 1.**

|  |  |
| --- | --- |
| **Company** | **Comments Option 1** |
| ZTE | For conformance testing part, if 1-O is also approved, the one radiated spec should be specified similar as 38.141-2 for NR BS or 38.176-2 for IAB. |

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| Ericsson | No.  We don’t agree with the proposed changes for the reasons given in 4-1-3 and 4-1-4. Also, RAN4 doesn’t send LS to RAN to update WI, Rapporteur shall propose such revision to RAN. |
| **Qualcomm** | **No.**  **We don’t think there is a need to have a new specification for NTN UE.** |
| Huawei | If RAN4 have to send a LS to RAN plenary in this meeting, this recommendation can be added as well. |

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| THALES | For FR1 such new specification may not be required, unless you want to include UE specifications for FR2. |

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| Nokia | There is no need for this LS |
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**Issue 4-4-2:** LS to RAN3

* Proposals
  + Option 1: **Send a LS to RAN3 and telling them to replace the gNB with S-gNB in the architecture figure.**



**Figure 2-1 NTN architecture**

* + ***Note: See R4-2113451,*** RAN4 respectfully asks RAN3 to consider whether the above RAN4 finding is correct and consider it in the future work if reasonable.
* Recommended WF
  + TBA

**Please provide your opinions/comments with respect to Option 1.**

|  |  |
| --- | --- |
| **Company** | **Comments Option 1** |
| ZTE | It’s not needed. |



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| Ericsson | No  RAN3 specifications are RAN3’s responsibility, it’s not up to RAN4 to tell RAN3 what to write in RAN3 specifications. Such change should be proposed by RAN3 delegates. |
| **CATT** | **We think the architecture is very important and is closedly related to how to name the RAN4 specification. Of course RAN4 cannot mandate what RAN3 specification will write. But this is triggered by RAN4 specification naming discussion. RAN4 should communicate the related discussion and RAN4 understanding and let RAN3 decide. Information LS is needed to avoid same disputation happen in both groups. We can discuss how to soft the wording.** |
| **Qualcomm** | **There is no need to do this…** |
| **Hughes/EchoStar** | **No** |
| Huawei | No.  1. The name S-gNB is not good, it can be confusing. (it is similar to the name of secondary gNB when we have EN-DC)  2. Currently, the necessity of changing the name needs to be clarified. At least for transparent payload, gNB remains almost all functions as it is in the TN case. |

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| THALES | We could use “Sat-gNB” |

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| Nokia | There is no need for this LS |
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## Companies views’ collection for 1st round

### Open issues

**Example 1**

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| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #5: HAPS Generalities

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2113689](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113689.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: RAN4 work on FR2 band support for NTN is per RAN agreement not to be started before after March 2022, and once FR1 NTN coexistence study is stable enough.**  **Observation 2: The spectrum usage on the service link for HAPS might be a different spectrum allocation than for Satellite.**  **Proposal 1: RAN4 to discuss which FR1 spectrum and potentially excisting NR bands can be considered for HAPS operation.**  **Proposal 2: HAPS and TN operations in should be coordinated if excisting NR bands are to be used for HAPS deplyments.** |
| [R4-2112145](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112145.zip) | SoftBank Corp., Deutsche Telekom | **Proposal 1: No need to classify new BS type for HAPS. For satellite, the new BS type or prefix should be specified for “satellite”, not “NTN”.**  **Proposal 2: No need to define new BS class for HAPS at the present time. For satellite, the new BS class should be specified for “satellite”, not “NTN”.** |
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## Open issues summary

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

### Sub-topic 5-1

*Sub-topic description:* HAPS Spectrum Issues

*Open issues and candidate options before e-meeting:*

**Issue 5-1-1:** Spectrum usage for HAPS

* Proposals
  + Option 1: The spectrum usage on the service link for HAPS might be a different spectrum allocation than for Satellite.
  + Option 2:
* Recommended WF
  + Option 1 (if no other options).

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Agree | We shall follow ITU allocation. |
| Samsung | Agree | Band configurations for HAPS are very likely different from satellites’ |
| Qualcomm | Agree |  |
| SoftBank | Agree | It has been agreed in RAN#91-e (see WID RP-210908, clause 3). |
| Nokia | Agree |  |
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**Issue 5-1-2:** FR1 Spectrum for HAPS operation

* Proposals
  + Option 1: RAN4 to discuss which FR1 spectrum and potentially existing NR bands can be considered for HAPS operation.
* Recommended WF
  + Option 1 (if no other options).

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Agree | Again, we shall follow ITU allocation. |
| Samsung | Agree | The spectrum usage for service link of HAPS should follow the Radio Regulations. In addition, note that the candidate bands are under discussion in ITU-R WP 5D. |
| Qualcomm | Agree | In HAPS co-ex, we select 2GHz as the exemplary band. |
| Huawei |  | It’s based on operators’ demand. RAN4 has clarified that IMT-based spectrum can be used. |
| SoftBank | Agree | 2GHz has been used in HAPS related coexistence studies. |
| Nokia | Agree |  |
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### Sub-topic 5-2

*Sub-topic description:* HAPS and TN operations

*Open issues and candidate options before e-meeting:*

**Issue 5-2-1:** HAPS and TN operations

* Proposals
  + Option 1: HAPS and TN operations in should be coordinated if existing NR bands are to be used for HAPS deployments.
* Recommended WF
  + Maybe reformulation of Option 1 is a bit required.

**Please provide your opinions/comments with respect to Option 1.**

|  |  |
| --- | --- |
| **Company** | **Comments Option 1** |
| Ericsson | As Moderator suggested, the proposal should be clarified, it’s unclear what’s the intention is here. Should the coordination be done between operators? Same operator?... |
| Nokia | The intention is that a TN operation having the license to a band can coordinate TN and HAPS deployments within this. Interference from these deployments towards other operators’ operation in other bands of parts of the band will, if unavoidable, need to be coordinated in a similar manner as TN are coordinated. |
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**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Agree |  |
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### Sub-topic 5-3

*Sub-topic description:* BS type for HAPS

**Issue 5-3-1:** BS type for HAPS

* Proposals
  + Option 1: **No need to classify new BS type for HAPS.** For satellite, the new BS type or prefix should be specified for “satellite”, not “NTN”.
* Recommended WF
  + Option 1 (if no other option).

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Agree | We could reuse TN BS type as done for NTN. Still, we don’t expect 1-C will be used in HAPS context. |
| SoftBank | Agree |  |
| Nokia | Agree |  |
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**Issue 5-4-1:** BS class for HAPS

* Proposals
  + Option 1: **No need to define new BS class for HAPS at the present time.** For satellite, the new BS class should be specified for “satellite”, not “NTN”.
* Recommended WF
  + Option 1 (if no other option).

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Partially agree | Let’s consider this as the current assumption. RAN4 would re-visit this when HAPS requirements will be specified, if HAPS requirements are diverging from WA, MR and LA ones. |
| SoftBank | Agree | We also agree with Ericsson. |
| Nokia | Agree |  |
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## Companies views’ collection for 1st round

### Open issues

**Example 1**

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| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #6: FR2 Generalities

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2111932](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111932.zip) | CATT | **Proposal 1: Define FR1 as 410 MHz ~ 7125 MHz in Rel-17 and defer FR2 definition to Rel-18.** |
| [R4-2113689](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113689.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: RAN4 work on FR2 band support for NTN is per RAN agreement not to be started before after March 2022, and once FR1 NTN coexistence study is stable enough.** |
| [R4-2114410](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114410.zip) | Huawei | **Proposal 1**: agree to send LS to RAN, with the RAN4 recommendation to proceed on the 7 – 24 GHz WI, as the building block for the future RAN4 work on the FR2 NTN scenario.  If the above proposal would be acceptable by RAN4, Huawei is willing to draft the related LS during the August RAN4 meeting.   |  |  | | --- | --- | | RAN#92-e agreements | Analysis | | *Proposal 2: RAN4 work is to be started after March 2022, and once FR1 NTN coexistence study is stable enough.* | Such timeline allows to perform the RF analysis work for the (potential) 7-24 GHz WI, before the Ka band related work starts in RAN4. | | * *The RAN4 technical aspects associated with the deployment of NTN in FDD mode in bands above 10 GHz will be identified/characterized prior to the normative work as part of an analysis (including coexistence study and taking regulatory requirements into account).* |  | | * + *Note 1: This should include study/discussion of which part of Ka band can be used for the example band for NR-NTN above 10 GHz and whether it should be MSS, FSS or both taking into account deployment type (e.g. VSAT, ESIM)* | Consideration of the “example band” only may not be the optimal approach here, i.e. conclusions drawn based on the example band may not be applicable to other future NTN band proposals within 7-24GHz range.  The RF characteristics analyses of the whole 7-24GHz range could be covered in the (potential) 7-24 GHz WI. | | * + *Note 2: The Ka band (17.7-20.2 and 27.5-30) as common across all regions is priority* |  | | * + *Note 3: Satellite bands introduced in 3GPP for NTN for FDD shall not impact the existing 3GPP TDD specifications for terrestrial bands* | For the existing FR2, there are both, band-agnostic requirements, as well as band-specific requirements.  It should be further clarified that Ka (FDD band) RF requirements will not be possible to simply reuse the existing FR2 requirements (based on 28GHz TDD band). Case-by-case analysis will be required for all the RF requirements. | | * *RAN4 to take a look at the NTN bands above 10GHz and decide which “FR” properties they should be based upon, and make the requirements based on this.* | This directly refers to the discussion in section 2.1. There is currently not possible for RAN4 to decide on its own on the 7-24GHz range, as (according to the TR 38.820) other RAN working group’s involvement is also required.  Regarding “*make the requirements based on this*”: as indicated above, RF requirements will not be possible to simply reuse the existing FR2 requirements (based on 28GHz TDD band). Case-by-case analysis will be required for all the RF requirements. | | * + *Definition of NTN band(s) above 10 GHz does not change the current FR1/FR2 definition* | It requires further analysis and clarifications, how the Ka could be implemented and signaled, if it would not be classified as FR1, nor FR2. Such decision is considered to be beyond NTN WI, as it impacts the whole 3gpp framework. | | * + *Definition of NTN band(s) above 10 GHz does not automatically apply to future terrestrial bands defined in this frequency region* | In general we do acknowledge, that band-specific work shall not have implications on other possible bands. Still, more discussion is needed on the approach for the NTN bands implementation in 3gpp specifications.  On “*this frequency region*”: there may be need to clarify, whether it shall be understood as 7-24GHz, 10-24GHz, or other range. |   Based on the above analysis, it is seen that the 7 – 24 GHz range framework completion (i.e. not Ka band specific patches) would be beneficial, and workload efficient. In case of other (NTN) bands being proposed for this range, RAN4 would need to repeat the whole exercise. |
| [R4-2114412](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114412.zip) | Huawei | **Proposal 1**: agree on the NTN bands numbering based on the following principles:   * No separate NR bands numbering range for NTN, * NTN bands numbering to reuse the existing band numbering range for FR1 (and for FR2, if needed in future).  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 5.2 *Operating bands* NR is designed to operate in the *operating bands* defined in table  5.2-2.  Table 5.2-2: NR *operating bands* in FR2   |  |  |  | | --- | --- | --- | | NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode | | n257 | 26500 MHz – 29500 MHz | TDD | | n258 | 24250 MHz – 27500 MHz | TDD | | n259 | 39500 MHz – 43500 MHz | TDD | | n260 | 37000 MHz – 40000 MHz | TDD | | n261 | 27500 MHz – 28350 MHz | TDD | | n262 | 47200 MHz – 48200 MHz | TDD | | [NTNband#3\_n263] | TBD | TDD | | |

## Open issues summary

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

**Moderator note:** Note that RAN-P decisions from RP-210791 can be used in RAN4:

**RAN-P decisions from RP-210791:**

* **Agreed Proposal NTN-1.1: “For frequencies above 10 GHz, any work can be limited to VSAT, ESIM service and terminals.”**
* **Agreed Proposal NTN-1.2: “The Satellite Ka band refers to [17.3 – 20.2 GHz] on the downlink and [27.0 – 30.0 GHz] on the uplink as allocated by ITU-R to satellite services. Some of this range is designated as FSS and some as MSS.”**

**Moderator note:** As per RAN#92, see **RP-211596**

**RAN-P decisions from RP-211596:**

* Proposal 1: RAN#92-e to endorse at least a portion of the “Ka Band” as the candidate example band for NTN-NR in above 10 GHz bands. ~~for GEO and NGSO based satellite access.~~
  + Note: Any final confirmation of the example band for NTN-NR above 10 GHz is pending the outcome of the technical analysis in Proposal 2.
* Proposal 2: RAN4 work is to be started after March 2022, and once FR1 NTN coexistence study is stable enough.
  + The RAN4 technical aspects associated with the deployment of NTN in FDD mode in bands above 10 GHz will be identified/characterized prior to the normative work as part of an analysis (including coexistence study and taking regulatory requirements into account).
    - Note 1: This should include study/discussion of which part of Ka band can be used for the example band for NR-NTN above 10 GHz ~~and whether it should be MSS, FSS or both~~ taking into account deployment type (e.g. VSAT, ESIM)
    - Note 2: The Ka band (17.7-20.2 and 27.5-30) as common across all regions is priority
    - Note 3: Satellite bands introduced in 3GPP for NTN for FDD shall not impact the existing 3GPP TDD specifications for terrestrial bands
  + RAN4 to take a look at the NTN bands above 10GHz and decide which “FR” properties they should be based upon, and make the requirements based on this.
    - Definition of NTN band(s) above 10 GHz does not change the current FR1/FR2 definition
    - Definition of NTN band(s) above 10 GHz does not automatically apply to future terrestrial bands defined in this frequency region

### Sub-topic 6-1

*Sub-topic description:* RAN4 work on FR2 band support for NTN

*Open issues and candidate options before e-meeting:*

**Issue 6-1-1:** RAN4 work on FR2 band support for NTN

* Proposals
  + Option 1:
    - Define FR1 as 410 MHz ~ 7125 MHz in Rel-17 and **defer FR2 definition to Rel-18**.
  + Option 2:
    - RAN4 work on **FR2 band support for NTN is per RAN agreement not to be started before after March 2022**, and once FR1 NTN coexistence study is stable enough.
* Recommended WF
  + Follow RAN plenary agreements (option 2).

**Question: Do you partially agree/disagree with the recommended way forward stated above? Please provide your views on the recommended Way Forward stated above.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| Ericsson | Agree | We shall respect RAN decision, we could start working on NTN FR2 work. Let’s focus on finalizing NTN FR1 first. |
| Qualcomm | Agree |  |
| Hughes/EchoStar | agree |  |
| THALES | Agree |  |
| Panasonic | Agree |  |
| Nokia | Agree |  |
| Apple | Agree |  |
| ESA | Agree |  |
| Huawei | Agree | We shall follow RAN agreements by default. |
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### Sub-topic 6-2

*Sub-topic description:* LS to RAN-P on 7-24 GHz usage

*Open issues and candidate options before e-meeting:*

**Issue 6-2-1:** LS to RAN-P on 7-24 GHz usage

* Proposals
  + Option 1:
    - **Agree to send LS to RAN**, with the RAN4 recommendation to proceed on the 7 – 24 GHz WI, as the building block for the future RAN4 work on the FR2 NTN scenario**.**
      * *Note:* ***Relevant*** *for FR2 NTN scenario ranges under discussion*
  + Option 2:
    - **Do not agree to send LS to RAN**, with the RAN4 recommendation to proceed on the 7 – 24 GHz WI, as the building block for the future RAN4 work on the FR2 NTN scenario**.**
      * *Note:* ***Not relevant*** *for FR2 NTN scenario ranges under discussion*
* Recommended WF
  + TBA

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| ZTE |  | Option 2, RAN4 high workload in RAN4 should be respected, we don’t think it’s needed to trigger the discussion for 7-24GHz due to NTN. |
| Ericsson | No  RAN4 doesn’t send such kind of LS to RAN, WIs are proposed directly to RAN.  We shall also respect RAN decision. | Yes  For the reasons given in option 1. |
| **Hughes/EchoStar** | **Agree** |  |
| T-Mobile USA | No. | Yes |

|  |  |  |
| --- | --- | --- |
| THALES | Not clear. We could send, but 7-24 GHz is not what it has been previously discussed for NTN FR2. |  |

|  |  |  |
| --- | --- | --- |
| Panasonic | Agree, but we understand THALES view. |  |
| **Nokia** | **No** | **Yes** |
| **Apple** | **No** | **Yes** |
| **Huawei** | Agree.  @ZTE: as we were not suggesting timeline of the potential WI – timeline of such work would be related to the previous FR2-related RAN agreements.  @Ericsson: we are aware of the FR2-related RAN agreement. More details on timeline would probably clarify most of the concerns here.  That proposal was motivated to prepare RAN4 framework for that missing 7-24 part of the Ka band. |  |
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### Sub-topic 6-3

*Sub-topic description:* Potential FR2 Parameterization (if needed in the future)

**Moderator note:** with respect to companies proposals.

**Issue 6-3-1:** Potential FR2 Numbering (if needed in the future)

* Proposals
  + Option 1: NTN bands numbering to reuse the existing band numbering range for FR2 (if needed in future).

NR *operating bands* in FR2

|  |  |  |
| --- | --- | --- |
| NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode |
| n257 | 26500 MHz – 29500 MHz | TDD |
| n258 | 24250 MHz – 27500 MHz | TDD |
| n259 | 39500 MHz – 43500 MHz | TDD |
| n260 | 37000 MHz – 40000 MHz | TDD |
| n261 | 27500 MHz – 28350 MHz | TDD |
| n262 | 47200 MHz – 48200 MHz | TDD |
| [NTNband#3\_n263] | TBD | TDD |

* + Option 2: NTN bands numbering to reuse the existing band numbering range for FR2 (if needed in future).

NR *operating bands* in FR2

|  |  |  |
| --- | --- | --- |
| NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode |
| n257 | 26500 MHz – 29500 MHz | TDD |
| n258 | 24250 MHz – 27500 MHz | TDD |
| n259 | 39500 MHz – 43500 MHz | TDD |
| n260 | 37000 MHz – 40000 MHz | TDD |
| n261 | 27500 MHz – 28350 MHz | TDD |
| n262 | 47200 MHz – 48200 MHz | TDD |
| [NTNband#3\_n263] | TBD | **FDD** |

* + Option 3: **NTN satellite band in FR2 will have three digits number, with the first digit being “3”.**
    - **Note:** e.g: s3 (similar as s1 or s2)
* Recommended WF
  + TBA
  + Moderator note: please also consider that NTN FR2 should most probably be FDD and not TDD.

**Question: Which option (listed above) do you prefer? Please provide your answer(s) e.g. “Yes” or “No”.**

[Note: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| Ericsson | **No**  For the reasons given for FR1 in 1-2-1 | This is same option as option 1, right?  No  For the reasons given for FR1 in 1-2-1 | No  That was not our proposal actually: we propose to define satellite FR2 bands with “s2xx”, not following FR1 numbering… |
| T-Mobile USA | No | No | No |

|  |  |  |  |
| --- | --- | --- | --- |
| Thales |  | Yes | Potentially Yes |

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| --- | --- | --- | --- |
| **Nokia** | **No** | **No** | **No** |
| **Apple** | Referring to the RAN guidance, this can be discussed later, no need to discuss NTN for FR2 now. | | |
| **Huawei** | FR2 discussion seems not in a rush right now. Can be postponed. | Doubled Option 1? | No  This would block significant part of the numbering range from TN bands. |
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## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Ericsson | Dominique Everaere | dominique.everaere@ericsson.com |
| Qualcomm | Bin Han | binhan@qti.qualcomm.com |
| T-Mobile USA | Bill Shvodian | bill.shvodian@t-mobile.com |
| Nokia | Johannes Hejselbaek | Johannes.hejselbaek@nokia.com |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Appendix: Companies contribution summary

Contribution summaries are as follows:

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2114469](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114469.zip) | Hughes/EchoStar, Inmarsat, Sateliot, Thales | Figure 1: MSS S-Band 1980-2010 and 2170-2200 MHz [2] to be adapted for NTN-NR band  **Observation 1:** RAN4#98-e endorsed MSS S-Band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as the NTN FR1 exemplary band, to be completed in Rel-17.  **Proposal 1:** RAN4 work to focus on the MSS specific range [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] for the NTN FR1 exemplary band.  **Observation 2:** In the US and Canada, the MSS S-band has been assigned for terrestrial use on a national basis. Therefore the MSS S-band definition for NTN-NR in this range will not apply for US and Canada [3].  **Observation 3**: The MSS S-Band range for Mexico is not aligned with 1980-2010 and 2170-2200 MHz.  **Proposal 2:** The MSS S-band definition for NTN-NR [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] as part of the Rel-17 NR-NTN WI does not apply for North America (US, Canada and Mexico).  **~~Proposal 3~~**~~: RAN4 to consider analysis of co-existence with N1 and N34 as adjacent bands to MSS S-Band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)].~~  **~~Observation 4~~**~~: As demonstrated in Figure 1, there are no NTN (satellite) bands adjacent to MSS S-band range of 1980-2010 and 2070–2200 MHz.~~  **~~Proposal 4~~**~~: RAN4 shall consider this as the input from operators that NTN-NTN (satellite) adjacent band co-existence for MSS S-band [1980-2010 MHz (UL) and 2170-2200 MHz (DL)] is not applicable and out of scope.~~  **[Moderator Note]** Proposals 3 & 4, together with Observation 4 to be considered by **[100-e][313] NTN\_Solutions\_Part2**. |
| [R4-2112390](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112390.zip)  and  [R4-2112391](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112391.zip) | GLOBALSTAR Inc. | Table 1: Regulatory parameters of the L-band and S-band   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Band** | **Frequencies (MHz)** | **Direction** | **Total BW (MHz)** | **Regions** | | **L-band** | 1518-1559 | Space to Earth (DL) | 41MHz (DL) | 1, 2, 3 | | 1610-1613.8 | Earth to Space (UL) | 3.8MHz (UL) | | 1613.8-1626.5 | Earth to Space (UL)  Space to Earth (DL) | 12.7MHz (UL/DL) | | 1626.5-1660.5 | Earth to Space (UL) | 34MHz (UL) | | 1668-1668.4 | Earth to Space (UL) | 7MHz (UL) | | 1668.4-1670 | Earth to Space (UL) | | 1670-1675 | Earth to Space (UL) | |  |  |  |  |  | | **S-band** | 1980-2010 | Earth to Space (UL) | 30MHz (UL) | 1, 2, 3 | | 2010-2025 | Earth to Space (UL) | 15MHz (UL) | 2 | | 2160-2170 | Space to Earth (DL) | 10MHz (DL) | 2 | | 2170-2200 | Space to Earth (DL) | 30MHz (DL) | 1, 2, 3 | | 2483.5-2500 | Space to Earth (DL) | 16.5MHz (DL) | 1, 2, 3 | | 2500-2520 | Space to Earth (DL) | 20MHz (DL) | 3 | | 2670-2690 | Earth to Space (UL) | 20MHz (UL) | 3 |   **Observation 1:** While most of the S-band satellite allocations match NR standard channel bandwidths, there are allocations on the S-band, and especially on the L-band, size of which is "irregular".  **Observation 2:** Using next smaller NR standard channel will result in quite noticeable resource wastage.  **Observation 3:** 3GPP has an ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths" where solutions for irregular channel bandwidths are considered.  **Proposal 1:** We ask 3GPP to consider NTN irregular channel bandwidths in the context of the ongoing SI on "Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths".  **Proposal 2:** As an operator request, we ask to consider irregular channel bandwidths from L-band (1610–1618.725MHz) and S-band (2483.5–2500MHz) spectrum allocations. |
| [R4-2111932](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111932.zip) | CATT | **Proposal 1: Define FR1 as 410 MHz ~ 7125 MHz in Rel-17 and defer FR2 definition to Rel-18.**  **Proposal 2: The same set of band coding and signaling design should be used for NTN and NR. The NTN band is numbered in reverse order from the maximum NR band number in each FR.**  **Proposal 3: The NTN band should be numbered as a new band even though it is fully overlapped with a TN band.**  **Proposal 4: The channel bandwidth and the number of RBs can be reused from TN. The supported channel bandwidths need to be specified for the new NTN band.**  **Proposal 5: Current channel spacing definition in TS 38.104 is applicable for NTN system.**  **Proposal 6: Current channel raster defined in TS38.104 can be applied for NTN system. Channel raster entries for NTN band need to be specified.**  **Proposal 7: The synchronization raster entries for NTN bands need further study based on operator input.** |
| [R4-2113745](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113745.zip) | Ericsson | **Proposal1: Specify the following system parameters for NTN s1 and s2 bands:**   |  |  |  |  | | --- | --- | --- | --- | | NTN *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode | | s11 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD | | s2 | 1626.5 MHz – 1660 5 MHz | 1525 MHz – 1559 MHz | FDD | | NOTE 1: Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision) | | | |  | NTN Band | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | | --- | --- | --- | --- | --- | --- | |  | 15 | Yes | Yes | Yes | Yes | | s1 | 30 |  | Yes | Yes | Yes | |  | 60 |  | Yes | Yes | Yes | |  | 15 | Yes | Yes | Yes | Yes | | s2 | 30 |  | Yes | Yes | Yes | |  | 60 |  | Yes | Yes | Yes |   **Proposal2: Further study if NTN ARFCN and GSCN should be simplified, reducing the range of values.** |
| [R4-2113689](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113689.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: RAN4 work on FR2 band support for NTN is per RAN agreement not to be started before after March 2022, and once FR1 NTN coexistence study is stable enough.**  **Observation 2: The spectrum usage on the service link for HAPS might be a different spectrum allocation than for Satellite.**  **Proposal 1: RAN4 to discuss which FR1 spectrum and potentially excisting NR bands can be considered for HAPS operation.**  **Proposal 2: HAPS and TN operations in should be coordinated if excisting NR bands are to be used for HAPS deplyments.** |
| [R4-2113928](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113928.zip) | ZTE Corporation | **Proposal 1**: NTN band numbering could still follow the “first come first served ” principle  **Proposal 2**: to postpone the SU discussion until there are clear agreement for out-of-band emission requirement and in-band emission requirements defined for NTN;  **Proposal 3**: for NTN S band, the following system parameters should be adopted.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | NR operating band | UL [MHz] | | DL [MHz] | | Duplexer | Fglobal [KHz] | channel raster [KHz] | UL NREF | | DL NREF | | SSB Block SCS [KHz] | SSB Pattern | GSCN\_L | GSCN\_H | | [10x] ? | 1980 | 2010 | 2170 | 2200 | FDD | 5 | 100 | 396000 | 402000 | 434000 | 440000 | 15 | Case A | 5429 | 5494 | |
| [R4-2113183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113183.zip) | CMCC | **Observation 1: there are three options for NTN band numbering scheme as below.**   * **Option 1: reserve some contiguous operating band numbers for NTN network** * **Option 2: start NTN number from the maximum operating number (n256) in NR spec and then define band number in descending order.** * **Option 3: define NTN operating band number just after the maximum numbers that has been used by NR system**   **Proposal 1: define NTN band number in increasing order after the maximum band number that has been used by NR system when new NTN bands are proposed.**  Table 2: S band definition for NTN networks   |  |  |  |  | | --- | --- | --- | --- | | **NR *operating band*** | **Uplink (UL) *operating band* BS receive / UE transmit**  **FUL,low – FUL,high** | **Downlink (DL) *operating band* BS transmit / UE receive**  **FDL,low – FDL,high** | **Duplex Mode** | | n100 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |   **Proposal 2: S band is suggested to be defined as in table 2.** |
| [R4-2112145](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112145.zip) | SoftBank Corp., Deutsche Telekom | **Proposal 1: No need to classify new BS type for HAPS. For satellite, the new BS type or prefix should be specified for “satellite”, not “NTN”.**  **Proposal 2: No need to define new BS class for HAPS at the present time. For satellite, the new BS class should be specified for “satellite”, not “NTN”.** |
| [R4-2112009](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112009.zip) | CATT | **Proposal 1: It is proposed to define type 1-C and type 1-H requirements for NTN BS in Rel-17 and use the figure 2-1 and 2-2 as the reference architecture.**    2-1 NTN BS type 1-C reference interface    2-2 NTN BS type 1-H reference interface  **Proposal 2: It is proposed to introduce 3 NTN BS types,**   * + - **NTN BS class A representing a typical operating altitude of 35786/50000 km**     - **NTN BS class B representing a typical operating altitude in the range of 7000-25000 km**     - **NTN BS class C representing a typical operating altitude in the range of 300-1500 km** |
| [R4-2113184](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113184.zip) | CMCC | **Observation 1: it seems NTN gNB could be classified by different altitudes or altitude ranges to differentiate RF requirements.**  **Proposal 1: NTN gNB classes are characterised by requirements derived from different satellite types with certain satellite to ground altitude or altitude range.**  **Proposal 2: for S band, all the 1-C, 1-H, 1-O types are suggested for NTN network.** |
| [R4-2113929](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113929.zip) | ZTE Corporation | **Proposal 1**: BS type 1-H or BS type 1-O could be defined for NTN BS.    Figure 2. reflector antenna architecture with beam port/[RF connector]    Figure 3. Lens antenna architecture with beam port/[RF connector]    Figure 4. antenna array architecture with beam port/[RF connector]  **Proposal 2**: to define GEO/LEO-600KM/LEO-1200KM NTN BS with the criteria of NTN BS height. |
| [R4-2113744](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113744.zip) | Ericsson | **Proposal1: NTN BS would only specify BS types 1-H and 1-O, not BS type 1-C.**  **Proposal2: Define NTN BS class based (at least) on the considered satellite’s orbit.**  **Proposal3: Further discuss if, for each of those NTN BS classes, additional sub-classes should be considered.** |
| [R4-2114410](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114410.zip) | Huawei | **Proposal 1**: agree to send LS to RAN, with the RAN4 recommendation to proceed on the 7 – 24 GHz WI, as the building block for the future RAN4 work on the FR2 NTN scenario.  If the above proposal would be acceptable by RAN4, Huawei is willing to draft the related LS during the August RAN4 meeting.   |  |  | | --- | --- | | RAN#92-e agreements | Analysis | | *Proposal 2: RAN4 work is to be started after March 2022, and once FR1 NTN coexistence study is stable enough.* | Such timeline allows to perform the RF analysis work for the (potential) 7-24 GHz WI, before the Ka band related work starts in RAN4. | | * *The RAN4 technical aspects associated with the deployment of NTN in FDD mode in bands above 10 GHz will be identified/characterized prior to the normative work as part of an analysis (including coexistence study and taking regulatory requirements into account).* |  | | * + *Note 1: This should include study/discussion of which part of Ka band can be used for the example band for NR-NTN above 10 GHz and whether it should be MSS, FSS or both taking into account deployment type (e.g. VSAT, ESIM)* | Consideration of the “example band” only may not be the optimal approach here, i.e. conclusions drawn based on the example band may not be applicable to other future NTN band proposals within 7-24GHz range.  The RF characteristics analyses of the whole 7-24GHz range could be covered in the (potential) 7-24 GHz WI. | | * + *Note 2: The Ka band (17.7-20.2 and 27.5-30) as common across all regions is priority* |  | | * + *Note 3: Satellite bands introduced in 3GPP for NTN for FDD shall not impact the existing 3GPP TDD specifications for terrestrial bands* | For the existing FR2, there are both, band-agnostic requirements, as well as band-specific requirements.  It should be further clarified that Ka (FDD band) RF requirements will not be possible to simply reuse the existing FR2 requirements (based on 28GHz TDD band). Case-by-case analysis will be required for all the RF requirements. | | * *RAN4 to take a look at the NTN bands above 10GHz and decide which “FR” properties they should be based upon, and make the requirements based on this.* | This directly refers to the discussion in section 2.1. There is currently not possible for RAN4 to decide on its own on the 7-24GHz range, as (according to the TR 38.820) other RAN working group’s involvement is also required.  Regarding “*make the requirements based on this*”: as indicated above, RF requirements will not be possible to simply reuse the existing FR2 requirements (based on 28GHz TDD band). Case-by-case analysis will be required for all the RF requirements. | | * + *Definition of NTN band(s) above 10 GHz does not change the current FR1/FR2 definition* | It requires further analysis and clarifications, how the Ka could be implemented and signaled, if it would not be classified as FR1, nor FR2. Such decision is considered to be beyond NTN WI, as it impacts the whole 3gpp framework. | | * + *Definition of NTN band(s) above 10 GHz does not automatically apply to future terrestrial bands defined in this frequency region* | In general we do acknowledge, that band-specific work shall not have implications on other possible bands. Still, more discussion is needed on the approach for the NTN bands implementation in 3gpp specifications.  On “*this frequency region*”: there may be need to clarify, whether it shall be understood as 7-24GHz, 10-24GHz, or other range. |   Based on the above analysis, it is seen that the 7 – 24 GHz range framework completion (i.e. not Ka band specific patches) would be beneficial, and workload efficient. In case of other (NTN) bands being proposed for this range, RAN4 would need to repeat the whole exercise. |
| [R4-2113741](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113741.zip) | Ericsson | **Proposal1: The first band NTN based on L-band will have the following frequency range definition: 1626.5-1660.5 MHz in UL and 1525-1559 MHz in DL.**  **Proposal2: Add a note to the definition of the new band s1 ([4]) mentioning that: “Coexistence of terrestrial and satellite components shall be addressed following ITU Recommendation M.1036-6 and Resolution 212 (WRC-19 revision)”.** |
| [R4-2114412](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114412.zip) | Huawei | **Proposal 1**: agree on the NTN bands numbering based on the following principles:   * No separate NR bands numbering range for NTN, * NTN bands numbering to reuse the existing band numbering range for FR1 (and for FR2, if needed in future).   **Proposal 2**: The first NTN band to be allocated the next available FR1 band number, i.e. n100 (the number to be confirmed to avoid conflict with other spectrum work items).   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 5.2 *Operating bands* NR is designed to operate in the *operating bands* defined in table 5.2-1 and 5.2-2.  NB-IoT is designed to operate in the NR operating bands n1, n2, n3, n5, n7, n8, n12, n14, n18, n20, n25, n28, n41, n65, n66, n70, n71, n74, n90 which are defined in Table 5.2-1.  NTN is designed to operate in the NR operating band n100, [NTNband#2\_n101], [NTNband#3\_n263] which are defined in Table 5.2-1 [and Table 5.2-2].  Table 5.2-1: NR *operating bands* in FR1   |  |  |  |  | | --- | --- | --- | --- | | NR *operating band* | Uplink (UL) *operating band* BS receive / UE transmit  FUL,low – FUL,high | Downlink (DL) *operating band* BS transmit / UE receive  FDL,low – FDL,high | Duplex mode | | n1 | 1920 MHz – 1980 MHz | 2110 MHz – 2170 MHz | FDD | | n34 | 2010 MHz – 2025 MHz | 2010 MHz – 2025 MHz | TDD | | n65 | 1920 MHz – 2010 MHz | 2110 MHz – 2200 MHz | FDD | | n84 | 1920 MHz – 1980 MHz | N/A | SUL | | n951 | 2010 MHz – 2025 MHz | N/A | SUL | | n996 | 1626.5 MHz -1660.5 MHz | N/A | SUL | | n100 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD | | [NTNband#2\_n101] | TBD | TBD | TBD |   Table 5.2-2: NR *operating bands* in FR2   |  |  |  | | --- | --- | --- | | NR *operating band* | Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive  FUL,low – FUL,high  FDL,low – FDL,high | Duplex mode | | n257 | 26500 MHz – 29500 MHz | TDD | | n258 | 24250 MHz – 27500 MHz | TDD | | n259 | 39500 MHz – 43500 MHz | TDD | | n260 | 37000 MHz – 40000 MHz | TDD | | n261 | 27500 MHz – 28350 MHz | TDD | | n262 | 47200 MHz – 48200 MHz | TDD | | [NTNband#3\_n263] | TBD | TDD | | |
| [R4-2114471](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114471.zip) | THALES | **Proposal 1.** RAN4 to discuss with respect to the new NTN specification titles and eventually to clarify if any concerns with respect to their scope.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | | | Proposed Spec no. or series | Type | Title | For info  at TSG# | For approval at TSG# | Remarks | | *38.863* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Core part;* | | *38.108* | *TS* | **NR; Satellite Node radio transmission and reception** | 94-e | 95 | *Core part;* | | *38.181* | *TS* | **NR; Satellite Node conformance testing** | 96 | 97 | *Performance part;* | |
| [R4-2113740](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113740.zip) | Ericsson | **Proposal1: NTN satellite bands will be prefixed with “s”. NTN satellite band in FR1 will have one or two digits number, while NTN satellite band in FR2 will have three digits number, with the first digit being “3”.**  **Proposal2: The band s1 will have the frequency range: 1980-2010 MHz in UL and 2170-2200 MHz in DL.**  **Proposal3: The band s2 will be the name for the part of the L-band agreed to be used for NTN.** |
| [R4-2113430](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113430.zip) | Huawei, HiSilicon | **Observation 1: the “satellite node” defined in the revised WID doesn’t accurately reflect what was agreed in RAN4 and it doesn’t accurately match the assumption of transparent payload.**  **Observation 2: Ka band will be discussed after Rel-17, but neither TS 38.101-1 nor TS 38.101-2 is suitable to specify Ka band’s UE RF requirements.**  **Proposal 1: create a new TS for satellite UE RF requirements.**  **Proposal 2: send RAN plenary a LS to recommend revising the new specifications in NR NTN WID as in table 2.**  Table 2 Revision of new specifications as proposed   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **New specifications** *{One line per specification. Create/delete lines as needed}* | | | | | | | Proposed Spec no. or series | Type (see note 1) | Title | For info  at TSG# | For approval at TSG# | Remarks | | *38.8XX* | *Internal TR* | **NTN related RF and co-existence aspects** | 94-e | 95 | *Led by RAN4, rapporteur: Yiran Jin,* [*yiran.jin@samsung.com*](mailto:yiran.jin@samsung.com)  *Core part;* | | *38.1XX* | *TS* | **NR; Satellite Communication System radio transmission and reception: Access network part** | 94-e | 95 | *Led by RAN4, rapporteur: Dorin Panaitopol,* [*dorin.panaitopol@thalesgroup.com*](mailto:dorin.panaitopol@thalesgroup.com)  *Core part;* | | *38.1XX* | *TS* | NR; Satellite Communication System radio transmission and reception: User Equipment (UE) part | 94-e | 95 | *Led by RAN4, rapporteur: Peng Zhang zhangpeng169@huawei.com*  *Core part;* | | *38.1XX* | *TS* | **NR; Satellite Communication System conformance testing:**  **Access network part** | 96 | 97 | *Led by RAN4, rapporteur: Yuexia Song,* [*songyuexia@datangmobile.cn*](mailto:songyuexia@datangmobile.cn)  *Performance part;* | |
| [R4-2113450](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113450.zip) | CATT | **Proposal 1: Change the new NTN specification to the following names and introduce abbreviation later in the spec for S-gNB.**   * + - **《Satellite Base Station (S-BS) radio transmission and reception》**     - **《Satellite Base Station (S-BS) conformance testing》**   **Proposal 2: Send a LS to RAN3 and telling them to replace the gNB with S-gNB in the architecture figure.**    **Figure 2-1 NTN architecture** |
| [R4-2113451](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113451.zip) | CATT | **To RAN WG~~2~~3**  **ACTION:** RAN4 respectfully asks RAN3 to consider whether the above RAN4 finding is correct and consider it in the future work if reasonable. |
| [R4-2112517](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112517.zip) | Samsung | **Proposed contents TR 38.863**  Foreword 4  Introduction 5  1 Scope 6  2 References 6  3 Definitions of terms, symbols and abbreviations 6  3.1 Terms 6  3.2 Symbols 6  3.3 Abbreviations 7  4 General aspects 7  4.1 Work item objective 7  4.2 Reference points for RF requirements 7  5 Co-existence study 7  5.1 Co-existence simulation scenario 7  5.2 Co-existence simulation assumption 7  5.3 Co-existence simulation methodology 7  5.4 Co-existence simulation results 7  5.5 Summary of co-existence study 7  6 RF requirements 8  6.1 Common issues for satellite node and NTN UE 8  6.1.1 Operating bands and channel arrangements 8  6.1.2 Channel bandwidth, SCS and spectral utilization 8  6.1.3 Channel raster and sync raster 8  6.2 Satellite communication system requirements: Access Network Part 8  6.2.1 General 8  6.2.1.1 Satellite node class 8  6.2.2 Transmission characteristics 8  6.2.3 Receiver characteristics 8  6.2.4 Others 8  6.3 NTN UE requirements 8  6.3.1 General 8  6.3.2 NTN UE transmission characteristics 8  6.3.3 NTN UE receiver characteristics 8  6.3.4 Others 9  7 Regulatory aspects 9  7.1 ITU-R 9  Annex A: Simulation results of NTN components 10  Annex B: Simulation results of TN components 11  Annex C: To be added. 12  Annex D: Change history 13 |
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