**3GPP TSG-RAN WG4 Meeting # 100-e**  **R4-2115640**

**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:** Way Forward on NTN\_solutions\_Part1

**Document for:** Agreement

# Introduction

This proposed way forward is based on the outcomes of “Email discussion summary for [100-e][312] NTN\_Solutions\_Part1”, see **R4-2115784** (revision of R4-2115602). Moreover, as suggested by “**RAN4#100-e E-meeting Arrangements and Guidelines”**, this Way Forward uses WORD document rather than POWERPOINT (.PPTX) in order to facilitate others to comment and easily track the changes.

As described in R4-2115784, Email discussion summary for [100-e][312] NTN\_Solutions\_Part1 identified the following topics and issues:

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)

Please note that the following color code is further used:

* Agreed in GTW or by Chairman
* Agreeable – Suggested by Moderator as a result of 1st and 2nd round of discussions
* Not agreeable/Not consensus between companies.
* Comments from Moderator, or Moderator Notes

# Agreements

1. Topic #1: NTN System Parameters
   1. Issue 1-1-1: MSS S-Band Range Clarification

1st round GTW Agreement (20/08/2021):

NO need to capture such information into TS. Such information can be included into TR as regulatory information.

**2nd round candidate proposals (for clarification purpose only):**

*“NO need to capture regional information into TS. Such information can be included into TR as regulatory information”*

* 1. Issue 1-1-2: MSS L-Band Range Clarification

1st round GTW Agreement (20/08/2021):

If no consensus on L band definition with frequency ranges can be reached by Nov 2021 RAN4 meeting, then L band work can be postponed after March 2022.

**Moderator Note:** irregular channel bandwidths shall not been discussed in the context of NTN in Rel-17. According to GTW session on 20/08/2021, Irregular Channel BW discussions deferred from NTN in Rel-17. There is a dedicated (separate) NR SI for the topic.

**2nd round candidate proposals:**

**Proposal 1-1-2-1:** The first band NTN based on L-band will have the following frequency range definition: **1525-1559 MHz in DL, 1626.5-1660.5 MHz in UL (FDD).**

* **Note 1:** Other band definitions (addressing another frequency range in the L-band) are not precluded in the future, this will be release independent anyway.
* **Note 2:** Protection of GNSS and regional regulations must be meet when this band is deployed.

**Proposal 1-1-2-2:** RAN4 to define the **full L-band (1515-1559 MHz DL, 1626.5-1660.5 and 1668-1675 MHz UL)** while acknowledging the impracticality of the extended L-band segments in certain countries.

**Proposal 1-1-2-4:** Companies continue to contribute with L-band candidate ranges for NTN operation in FR1. **Note:** companies to decide L-band range and different deployment options.

* **Note:** other band definitions (addressing another frequency range in the L-band) are not precluded in the future, this will be release independent anyway. Same rules apply for S-band.
  1. Issue 1-2-1: NTN Band Coding and Signalling Design

1st round GTW Agreement (20/08/2021):

Introduce NTN band numbering respecting existing band coding and signalling design without changes on RAN2.

* 1. Issue 1-2-2: NTN Band Numbering

1st round GTW Agreement (20/08/2021):

Starting from the largest band number in FR1 range for NTN bands which fully within FR1 frequency ranges, the number can be taken in a decreased order with first come, first service.

FFS with prefix as “n’ or “s”. A note can be included to clarify the usage of NTN bands.

**2nd round candidate proposals:**

**Proposal 1-2-2-2:** The **NTN satellite band** should be numbered as a new band even though it is fully overlapped with a TN band.

* **Note 1:** band prefix FFS.
* **Note 2:** RAN4 will choose between “s” and “n” only.
  1. Issue 1-3-1: NTN Channel BandWidth

**2nd round candidate proposals:**

**Proposal 1-3-1-1:** RAN4 shall considerNTN **satellite** Channel BandWidth(s):

| NTN satellite band # | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| --- | --- | --- | --- | --- | --- |
|  | 15 | Yes | Yes | Yes | Yes |
| 256 | 30 |  | Yes | Yes | Yes |
|  | 60 |  | Yes | Yes | Yes |

where NTN satellite band number 256 range is defined as in

|  |  |  |  |
| --- | --- | --- | --- |
| NTN satellite *~~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 |
| 256 | 1980 MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |

* **Note 1:** band prefix FFS.
* **Note 2:** RAN4 will choose between “s” and “n” only.

**Proposal 1-3-1-2:** RAN4 shall considerNTN **satellite** Channel BandWidth(s)**:**

| NTN satellite band  # | SCS  kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| --- | --- | --- | --- | --- | --- |
|  | 15 | Yes | Yes | Yes | Yes |
| 255 | 30 |  | Yes | Yes | Yes |
|  | 60 |  | Yes | Yes | Yes |

where NTN satellite band number 255 range is defined as in

|  |  |  |  |
| --- | --- | --- | --- |
| NTN *~~operating~~ satellite 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 |
| 255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |

* **Note 1:** band prefix FFS.
* **Note 2:** RAN4 will choose between “s” and “n” only.

**Proposal 1-3-1-3:** 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.**

* **Note 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.” has been agreed in RAN#99-e (see Proposal 2-1-2-1 from agreed WF R4-2108099).
  1. Issue 1-3-2: NTN Channel Spacing

**2nd round candidate proposals:**

**Proposal 1-3-2-1: Current channel spacing definition in TS 38.104 is applicable for NTN system. The first NTN satellite 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.**
  1. Issue 1-4-1: NTN Channel Raster

**2nd round candidate proposals:**

**Proposal 1-4-1-1: Current channel raster defined in TS 38.104 can be applied for NTN system. Channel raster entries for NTN band need to be specified.**

**Moderator Note:** We already decided 100 kHz for both MSS S-Band and L-Band channel raster in R4-2108099:

- Proposal 3-1-5-1: RAN4 shall consider a 100 kHz MSS S-Band Channel Raster.

- Proposal 3-2-2-1: RAN4 shall consider a 100 kHz MSS L-Band Channel Raster.

* 1. Issue 1-4-2: NTN Synchronization Raster

**2nd round candidate proposals:**

**Proposal 1-4-2-2:** With respect to **MSS L-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.

**Moderator Note:** We already decided “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.” in R4-2108099.

* 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.
  1. Issue 1-4-3: NTN ARFCN and GSCN

**2nd round candidate proposals:**

**Proposal 1-4-3-1:**

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

|  |  |  |  |
| --- | --- | --- | --- |
| ~~NR~~ NTN *~~operating~~ satellite band #* | ΔFRaster  (kHz) | Uplink  range of NREF  (First – <Step size> – Last) | Downlink  range of NREF  (First – <Step size> – Last) |
| … | … | … | … |
| ~~[n256]~~256 | 100 | 396000 – <20> – 402000 | 434000 – <20> – 440000 |
| …… | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| ~~NR~~NTN *~~operating~~ satellite band #* | SS Block SCS | SS Block pattern (NOTE 1) | Range of GSCN  (First – <Step size> – Last) |
| … | … | ... | … |
| ~~[n256~~~~x~~~~]~~256 | 15 kHz | Case A | [5429] – <1> – [5494]  Or  [5419 ?] – <1> – [5494 ?] |
| ~~NOTE x: The following GSCN are allowed for operation in band n256: GSCN = {a1, a2, …}.~~ | | | |

**Note 1:** band prefix FFS.

**Note 2:** RAN4 will choose between “s” and “n” only.

**Note 3:** The exact value of GSCN is FFS.

1. Topic #2: NTN gNB Class/Type
   1. Issue 2-1-1: Satellite NTN gNB Type

1st round GTW Agreement (20/08/2021):

BS Type 1-H and 1- O will be supported for NTN BS in Rel-17. The baseline assumption BS type 1-C is not supported in Rel-17 NTN pending on further checking till Nov 2021 Nov Meeting.

Further check the progress on BS type 1-O in Nov 2021 RAN4 meeting.

* 1. Issue 2-2-1: Satellite NTN gNB Class – general
  2. Issue 2-2-2: Criteria for defining NTN gNB Class

1st round GTW Agreement (20/08/2021):

Introducing NTN BS classes pending on the further checking whether there is difference among different classes from RAN4 RF requirements aspects. It’s not precluded to introduce a generic single BS class in Rel-17 timeframe. At least introduce NTN BS class with wide coverage.

The candidate criterias as following:

* + 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 characterized 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.
  + Combined option 1 and option2 not excluded

**2nd round candidate 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.
    - Note: Combined Option 1 and Option 2 not excluded
  + **Option 2:** Define NTN gNB classes characterized 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.
    - Note: Combined Option 1 and Option 2 not excluded
  + **Option 3:** Define all NTN gNB classes (at least in a first stage) as wide coverage BS class.
    - Note: No differentiation between NTN gNB classes, orbit or altitude, no maximum power limitation. This option can be used at least as initial assumption.

**Moderator Note:** Moderator proposing new Option 2:

* + **Option 2:** Define NTN gNB classes characterized by requirements derived from different satellite types with certain satellite to ground altitude or altitude range.
    - Note 1: All NTN BS classes can be potentially considered equivalent as to Wide Area BS.
    - Note 2: Different NTN BS class should not consider different power limitations.
    - Note 3: [GTW Agreement] At least introduce NTN BS class with wide coverage

1. Topic #3: General Band Related Parameters
   1. Issue 3-1-1: Irregular Channel BW – general

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* 1. Issue 3-1-2: Irregular Channel BW allocation from L-Band and S-band

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

**2nd round candidate proposals:**

**Proposal 3-2-1-1: 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**).**

**Moderator Note:** New Proposal 3-2-1-1:

**Proposal 3-2-1-1: 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~~**~~).~~**

* **Note 1:** Coexistence work shall be continued in parallel with SU discussion in order to determine e.g. if guard band is enough for attenuation in adjacent channel.
  1. Issue 3-3-1: ITU Recommendation for S-Band

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1. 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

**2nd round candidate proposals:**

**Proposal 4-1-1-1:** 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;* |

**Moderator Note:** Table under discussion, see other candidate proposals below.

* 1. Issue 4-1-2: Title and Scope of NTN NR TR 38.863

**2nd round candidate proposals:**

**[MCC guidelines] Proposal 4-1-2-1:** The title of NTN NR TR 38.863 shall be “Non-terrestrial networks (NTN) related RF and co-existence aspect”.

**[Previous version] Proposal 4-1-2-1-bis:** The title of NTN NR TR 38.863 shall be “NTN related RF and co-existence aspects”.

* 1. Issue 4-1-3: Title and Scope of NTN NR TS 38.108

**2nd round candidate proposals:**

Option 2: NR; **Satellite Communication System radio transmission and reception: Access network part**

Option 2bis: **NR; Satellite Communication System radio “access” transmission and reception: ~~Access network part~~**

Option 4: NR; **Satellite Base Station (Sat-BS) radio transmission and reception**

**Moderator Note:** Companies are encouraged to agree with the definition for (**satellite** payload + feeder link + GW + **Non-NTN infrastructure** gNB):

- Satellite Access Node

- Satellite BS

- Satellite gNB

- Satellite Node B

- NTN Satellite gNB

- ..

RAN4 to agree with the definition for (**satellite** payload + feeder link + GW + **Non-NTN infrastructure** gNB) between the following options:

* Satellite Access Node
* Satellite BS
* Satellite gNB
* Satellite Node B
* NTN Satellite gNB



**Moderator Note:** Moderator proposes a new table, companies to declare **preference for** (payload + feeder link + GW + Non-NTN infrastructure gNB) naming, please answer only with **YES** for your preferences.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company** | Satellite Access Node | Satellite BS | Satellite gNB | Satellite Node B | NTN Satellite gNB |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Companies to declare **preference for** (payload + feeder link + GW + Non-NTN infrastructure gNB) naming, please answer only with **YES** for your preferences.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company** | Satellite Access Node | Satellite BS | Satellite gNB | Satellite Node B | NTN Satellite gNB |
|  |  |  |  |  |  |
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|  |  |  |  |  |  |
|  |  |  |  |  |  |

* 1. Issue 4-1-4: Title and Scope of NTN NR TS 38.181

**2nd round candidate proposals:**

Option 4: NR; **Satellite Base Station (Sat-BS) conformance testing**

**Moderator Note:** Moderator proposes as potentially agreeable:

TS 38.181 name shall be aligned with TS 38.108 name.

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

**2nd round candidate proposals:**

**1. For TR 38.863:**

* Move regulatory aspects to section 5
* RF reference points (4.2) 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”)
* Align (6.2) and (6.2.1.1) with the TS 38.181 and TS 38.108 naming discussion

2. **Agree** the **Table of Contents of TR 38.863, after the previous modifications**

|  |
| --- |
| **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 |

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

**2nd round candidate proposals:**

**Proposal 4-3-1-1:** 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.

**Moderator Note:** Moderator proposes as potentially agreeable:

* Handle VSAT after March 2022.
* Continue/postpone discussion after March 2022, since no FR2 or FR1 VSAT have been considered for the time being in Rel-17 (e.g. for coexistence studies, for FR1/FR2, or other agreement/discussion).

**Moderator Note:** The goal of the table below is to gather information. Any potential decision will be taken in RAN-P meeting, by proposing a WID update.

|  |  |  |
| --- | --- | --- |
|  | Pros | Cons |
| Creating a new **VSAT and handheld** NTN UE specification | **Huawei:** Antenna gain will be assumed for VSAT, so a new UE specification can be created considering the different requirements between VSAT and traditional TN UE. Given we have to create a new UE specification, all the NTN UE requirements can be specified in one specification for tracking. RAN4 can avoid FR1, FR2 or partial FR2 discussion on how to organize UE specification.  **Ericsson:** NTN UE requirements will be in the same specification, not spread between 2 TSs (depending on frequency range, type of UE, …). It’s still very easy to refer to 38.101-1 subclauses when the requirements are the same for NTN and TN.  **CATT:** we prefer new specification, not only handheld UE but also VSAT can be included in such specification.  ZTE: we also support to have new spec for NTN UE. For VSAT UE, this is not considered in the coexistence study, not sure whether this should also been captured. | **Qualcomm:** No need to create a new UE specification. As discuss in NTN UE RF (thread [314]), most of TN UE RF requirements can be reused for NTN UE. Even we have a new specification for NTN UE, we could not solve the Ka band issues since for FR1 we will specify conductive requirements but for Ka band radiated requirements will be defined.  **THALES:** We currently **do not perform any coexistence simulations for VSAT in FR1.** We proposed this, but it has not been accepted by other companies.  **VSAT** may refer in the future to both FR1 and FR2, and represents a **different class of UE**, and therefore it makes sense to introduce them together in a separate specification, starting **from Rel-18.**  **In Rel-17 we only have handheld devices.**  Please see the following agreements:   * RAN4#98-e meeting, WF for NTN general part, [R4-2103877](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2103877.zip): For RAN4 NTN coexistence studies in FR1, handheld devices could be prioritized (to be further discussed in the NTN coexistence analysis). * RAN4#98-e meeting, WF for NTN co-existence study, R4-2103878: NTN UE parameters: Handheld UEs for FR1.   **Propose to continue discussion in March 2022,** when **VSAT** options (**FR2 and FR1**) work could continue. (see e.g. decision Topic#6) |
| The satellite **handheld** UE RF requirements can be specified in TS 38.101**-1** together with other UE features | **Qualcomm:** Most of TN UE RF requirements can be used for NTN handheld UE RF. The framework is the same.  **THALES:** Agee with Qualcomm. For handheld (TNT) UE the current requirements are not different from existent ones. Why we want to make a new specification for this?  Please also note that we recommend not to impact any ACLR and ACS values of handheld UE for NTN. | **Huawei:** 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. The requirements for VSAT is different from 38.101-1. A separate VSAT requirements can be foreseen.  **Ericsson:** 38.101-1 is already too big document, very painful to navigate in it. Other type of NTN UEs won’t be specified in this TS 38.101-1, being possibly a source of confusion. |



**Moderator Note: According to RAN-P guidance (Proposal 1 and proposal 2 in RP-211596), RAN4 work on FR2 postponed until March 2022. No discussion on RAN4 FR2 from now on till March 2022.**

**Moderator Note:** Moderator proposes as potentially agreeable:

Continue discussion for NTN UE specification choice (if NTN handheld FR1 UE in TS 38.101-1 or not) in **March 2022**, when VSAT options (FR2 and FR1) work could continue.

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

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* 1. Issue 4-4-2: LS to RAN3

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1. Topic #5: HAPS Generalities
   1. Issue 5-1-1: Spectrum usage for HAPS

**2nd round candidate proposals:**

**Proposal 5-1-1-1:** The spectrum usage on the service link for HAPS might be a different spectrum allocation than for Satellite.

* 1. Issue 5-1-2: FR1 Spectrum for HAPS operation

**2nd round candidate proposals:**

**Proposal 5-1-2-1:** RAN4 to discuss which FR1 spectrum and potentially existing NR bands can be considered for HAPS operation.

* **Note:** Based on operators demand.
  1. Issue 5-2-1: HAPS and TN operations

**2nd round candidate proposals:**

**Moderator Note:** Reformulate the proposal “HAPS and TN operations in should be coordinated if existing NR bands are to be used for HAPS deployments”. Suggest a better phrase, according to 1st round of discussions.

**Moderator Note:** Moderator proposes as potentially agreeable:

Postpone discussion on this topic to RAN#101-e.

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

**2nd round candidate proposals:**

**Proposal 5-3-1-1:** **No need to classify new BS type for HAPS.** For satellite, the new BS type or prefix should be specified for “satellite”, not “NTN”.

* 1. Issue 5-4-1: BS class for HAPS

**2nd round candidate proposals:**

**Proposal 5-4-1-1:** The current assumption is **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”.

* **Note:** RAN4 would re-visit this when HAPS requirements will be specified, if HAPS requirements are diverging from WA, MR and LA ones.

1. Topic #6: FR2 Generalities

**According to RAN-P guidance (Proposal 1 and proposal 2 in RP-211596), RAN4 work on FR2 postponed until March 2022. No discussion on RAN4 FR2 from now on till March 2022. Discussion on Topic #6 shall be stopped after 1st round. All t-docs under topic #6 will be “Noted”.**

# Annex

Contact information

|  |  |  |
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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: GTW Discussions BS RF 20/08/2021

**GTW August 20th**

**Topic #6: FR2 Generalities**

**RAN4 session Chair Guidance: According to RAN-P guidance (Proposal 1 and proposal 2 in RP-211596), RAN4 work on FR2 postponed until March 2022. No discussion on RAN4 FR2 from now on till March 2022. Discussion on Topic #6 shall be stopped after 1st round. All t-docs under topic #6 will be “Noted”.**

**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.**
  + 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.**

**Discussion:**

Huawei: We supposed 1-C is possible for NTN BS. With one beam and large footprint, 1-C still possible.

Agreement:

BS Type 1-H and 1- O will be supported for NTN BS in Rel-17. The baseline assumption BS type 1-C is not supported in Rel-17 NTN pending on further checking till Nov 2021 Nov Meeting.

Further check the progress on BS type 1-O in Nov 2021 RAN4 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

**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.

**GTW discussion:**

Introducing NTN BS classes pending on the further checking whether there is difference among different classes from RAN4 RF requirements aspects. It’s not precluded to introduce a generic single BS class in Rel-17 timeframe. At least introduce NTN BS class with wide coverage.

The candidate criterias as following:

* 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 characterized 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.
* Combined option 1 and option2 not excluded

**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).

**Proposal 1-1-1-1:** 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).

**Or**

**Proposal 1-1-1-2:** 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)~~.

**Or**

**Proposal 1-1-1-3:** 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 (except Brazil, Costa Rica, and potentially other Central/South America countries)~~North America (US, Canada and Mexico)~~.

**Discussion:**

Apple: We don’t need to capture in the specification.

Ericssion: Proposal -1 is not correct.

Agreement:

NO need to capture such information into TS. Such information can be included into TR as regulatory information.

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

* Proposals
  + 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)

**Proposal 1-1-2-1:** The first band NTN based on L-band will have the following frequency range definition: **1525-1559 MHz in DL, 1626.5-1660.5 MHz in UL (FDD).**

**And/Or**

**Proposal 1-1-2-2:** RAN4 to define the **full L-band (1515-1559 MHz DL, 1626.5-1660.5 and 1668-1675 MHz UL)** while acknowledging the impracticality of the extended L-band segments in certain countries.

**And/Or**

**Proposal 1-1-2-3:** RAN4 to continue the discussion of the irregular channel bandwidths in the context of NTN in Rel-17.

**Moderator Note:** other companies are invited to contribute with L-band candidate ranges for NTN operation in FR1.

**Proposal 1-1-2-4:** Companies continue to contribute with L-band candidate ranges for NTN operation in FR1. **Note:** companies to decide L-band range and different deployment options.

**GTW discussion:**

Ericsson: We think -1 proposal more practical; -2 proposal more complexity which required more work.

Hughes/EchoStart: We suggest to wait the operators’ feedback.

MTK: We think RAN4 work load should be cared.

Agreement: If no consensus on L band definition with frequency ranges can be reached by Nov 2021 RAN4 meeting, then L band work can be postponed after March 2022.

**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.
  + 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”.

**Proposal 1-2-1-1:** 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”.

**Or**

**Proposal 1-2-1-2:** The same set of band coding and signaling design should be used for NTN **satellite band** and NR.

**GTW Discussion:**

Apple/ZTE/QC/CATT: Proposal -1 required changes on RAN2 signalling design. We prefer option 2.

CATT: We can consider to differentiate TN and satellite bands.

Apple: With prefixed not workable in RAN2 signalling design. Do we need to inform as satellite band information?

Ericsson: We agree option 1 has RAN2 impact; we think in RAN4 specification, it’s better to have some distinguish.

Nokia: We can add some note into specification to clearly mention the usage of bands similar as NR-U bands.

Agreement:

Introduce NTN band numbering respecting existing band coding and signalling design without changes on RAN2.

**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.

**GTW discussion:**

Echostar: Starting with n100 for NTN bands. (option 2)

ZTE: n100 probably already used. That’s the reason we suggest option 3. If we follow the previous logic, first come first service.

Ericsson: We think option 4 starting end of range, and with decreased order, with naming s256 only for RAN4 specification.

T-Mobile: We support option 4 idea.

QC: Option 4. If we using “s” may bring confusion to RAN2, we can use a note instead of different prefix.

Nokia: Option 4 with clear distinguish for the usage of NTN bands.

EchoStar: OK for option 4. The number should be in the range of FR1.

Huawei: We are fine with Nokia. Similar note as NR-U and NB-IoT.

Agreement:

Starting from the largest band number in FR1 range for NTN bands which fully within FR1 frequency ranges, the number can be taken in a decreased order with first come, first service.

FFS with prefix as “n’ or “s”. A note can be included to clarify the usage of NTN bands.

# Appendix: Submitted documents for [100-e][312] NTN\_Solutions\_Part1

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) is partially considered under **[100-e][312] NTN\_Solutions\_Part1**. The discussions concerning the coexistence analysis and related RAN4 simulation work are considered under **[100-e][313] NTN\_Solutions\_Part2**.

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

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