**3GPP TSG-RAN WG4 Meeting # 98-e R4-2103749**

**Electronic Meeting, 25th Jan. – 5th Feb., 2021**

**Agenda item:** 11.8.1, 11.8.2

**Source:** Moderator (THALES)

**Title:** Email discussion summary for [98e][310] NTN\_Solutions\_Part1

**Document for:** Information

# Introduction

This lead summary document captures issues related to NR NTN RF core requirements and demodulation aspects. The document provides information with respect to use cases, deployment scenarios and regulatory information to be considered, including exemplary band discussions. It contains a summary of the contributions under sections 11.8.1, 11.8.2 at TSG-RAN WG4 #98e, 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.

The NTN architecture discussion will be handled in this email thread including TDoc R4-2100111, and P1 of R4-2100487 from AI 11.8.3.3.

With respect to NTN architecture discussion, it has been also decided that (at least for the time being) BS Requirements will be considered in [98e][310] NTN\_Solutions\_Part1 and further used by [98e][311] NTN\_Solutions\_Part2 for coexistence studies.

With respect to “BS requirements”, contributions R4-2100487, R4-2101859, R4-2102176 will also be partially considered by [98e][310] NTN\_Solutions\_Part1. With respect to “NTN UL frequency synchronization requirement”, the contributions R4-2100780 and R4-2102893 have also been considered in [98e][310] NTN\_Solutions\_Part1 (from RRM list [98e][237]).

Please also note the draft TSG-RAN WG4 #98e meeting agenda with respect to NTN topic:

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

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

11.8.2 Use cases, deployment scenarios, and regulatory information [NR\_NTN\_solutions-Core]

\* Include exemplary bands discussion

* + 1. Coexistence aspects [NR\_NTN\_solutions-Core]
       1. Simulation assumptions [NR\_NTN\_solutions-Core]
       2. UE requirements aspects [NR\_NTN\_solutions-Core]
       3. BS requirements aspects [NR\_NTN\_solutions-Core]
    2. RRM core requirements [NR\_NTN\_solutions-Core]
       1. General [NR\_NTN\_solutions-Core]
       2. Timing requirements [NR\_NTN\_solutions-Core]
       3. Measurement requirements [NR\_NTN\_solutions-Core]

RAN4#98-e E-meeting Arrangements and Guidelines had proposed, the following schedule: Stage 1: Moderators kick off email discussion (Monday, Jan. 25th)

* Stage 2: Companies provide comments for the 1st round (Jan. 25th – Wednesday *6 PM UTC*, Jan. 27th)
* Stage 3: Moderators summarize the status and possible proposals, recommending what decisions can be made for 1st round. A formal TDoc will be used (Thursday *6 PM UTC*, Jan. 28)
* Stage 4: After receiving the summary from moderators, session chair may approve documents, make agreements or assign new CRs, WFs, LSs, etc. (no later than Monday 8am UTC, Feb. 1)
* Stage 5: Companies provide comments for 2nd round.
  + Draft WF/LS and revised CRs/TPs shall be shared by Wednesday 1am UTC, Feb. 3.
  + Commenting shall stop by Wednesday 11pm UTC, Feb. 3.
  + Formal TDocs of WF/LS/CRs/TPs shall be uploaded to the Inbox (except Cat A CRs) by Thursday 1am UTC, Feb. 4.
  + *Draft moderator summary shall be shared by Thursday 9 AM UTC, Feb. 4, but moderators are strongly encouraged to share it earlier if possible and delegates to comment as early as possible.*
* Stage 6: Moderators provide 2nd round summary with a formal TDoc by Thursday *6 PM UTC*, Feb. 4.
* Stage 7: Session chairs announce close of sessions (no later than *6 PM UTC*, Feb. 5). Final decisions will be captured in Chairman meeting report (to be shared after the meeting is closed)

A total of **16** TDocs have been provided for this agenda (please also see the **Annex** for details):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company*** | ***Status*** | ***General Purpose*** | ***Agenda Item*** |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Other | Discussion on exemplary bands for NTN topic | Huawei, HiSilicon | available | Approval | 11.8.1 |
| [R4-2102175](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102175.zip) | Other | NTN Reference model | Ericsson | available | Approval | 11.8.1 |
| [R4-2102173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102173.zip) | Other | NTN - Regulatory and spectrum aspects | Ericsson | available | Approval | 11.8.2 |
| [R4-2101933](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101933.zip) | Discussion | NTN - On use cases and deployment scenarios | Nokia, Nokia Shanghai Bell | available | Approval | 11.8.2 |
| [R4-2102374](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102374.zip) | Discussion | Discussion on satellite bands outside FR1/FR2 range for NR based satellite networks | HUGHES Network Systems, Thales, Inmarsat, Intelsat, Fraunhofer, ESA | available | Discussion | 11.8.2 |
| [R4-2101814](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101814.zip) | Other | General discussion on Network structure on NTN topics | Huawei, HiSilicon | available | Approval | 11.8.2 |
| [R4-2101858](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101858.zip) | Discussion | Criteria for Choosing FR1 Exemplary Band | THALES | available | Decision | 11.8.2 |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | Discussion | Discussion on frequency band and scenarios for NTN | CATT | available | Discussion | 11.8.2 |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | Discussion | Examplary bands for NTN | CMCC | available | Discussion | 11.8.2 |
| [R4-2100905](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100905.zip) | Discussion | Views on NTN exemplary bands | Samsung | available | Agreement | 11.8.2 |
| [R4-2100111](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100111.zip) | Discussion | NTN architecture aspects | THALES | available | Decision | 11.8.3.3 |
| [R4-2100487](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100487.zip) | Discussion | Consideration on BS requirement impact for NTN | CATT | available | Discussion | 11.8.3.3 |
| [R4-2101859](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101859.zip) | Discussion | NTN FR1 Coexistence Scenarios and Related Core Requirements | THALES | available | Decision | 11.8.3 |
| [R4-2102176](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102176.zip) | Discussion | NTN - BS requirements overview | Ericsson | available | Discussion | 11.8.3.3 |
| [R4-2100780](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100780.zip) | Discussion | Discussion on UE Pre-compensation for UL synchronization for in NTN | MediaTek inc. | available | Discussion | 11.8.4.1 |
| [R4-2102893](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102893.zip) | Discussion | Discussion on RRM in NTN Systems | Qualcomm Incorporated | available | Discussion | 11.8.4.1 |

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

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

The following 5 topics are listed as below to cover proposals and contents in these documents:

1. Topic #1: Use Cases and Deployment Scenarios

* Issue 1-1: IAB Requirements Discussion for VSAT
* Issue 1-2: UE Mobility Discussion
  + UE mobility for FR1
  + UE mobility for outside FR1
* Issue 1-3: FSS and ESIM
* Issue 1-4: UE-Type assumptions for FR1 (#97e)
  + proposals from general agenda – to be further considered in the coexistence discussion.
* Issue 1-5: UE-Type assumptions for outside FR1 (#98e)
  + proposals from general agenda – to be further considered in the coexistence discussion.
* Few Other Topics/Leftovers from RAN4#97e
  + Issue 1-6: FR1 exemplary frequency band
  + Issue 1-7: Inclusion of additional NR bands
  + Issue 1-8: TN BS/UE ACLR & ACS parameters

1. Topic #2: RAN4 NTN Architecture

* Issue 2-1: Satellite-FeederLink-Gateway Component
* Issue 2-2: Satellite-FeederLink-Gateway Component Type
* Issue 2-3: BS Requirement
  + *Moderator Note:* avoid potential duplication with [98e][311] NTN\_Solutions\_Part2
* Issue 2-4: Possible relaxation of some satellite RF parameters
* Issue 2-5: Reference Point Discussion
  + e.g. RF Link(s) or RF Reference Point(s) to be considered by RAN4 RF work
  + *Moderator Note:* Detail the component to be discussed by RAN4 as Service link and/or Feederlink and/or GW-gNB link
* Issue 2-6: Discussion for aspects out of scope of 3GPP RAN4 NTN Rel-17

1. Topic #3: Proposed FR1 Exemplary Frequency band for NTN

* Issue 3-1: Criteria to be considered for FR1 exemplary frequency band selection
* Issue 3-2: MSS S-Band or L-band decision
* Issue 3-3: Selection of FR1 Exemplary Band based on GNSS in-device coexistence issue

1. Topic #4: Proposed Exemplary Frequency band outside FR1 (e.g. FR2 and/or outside FR1&FR2) for NTN NR based satellite networks

* Issue 4-1: Consideration of Bands for NTN which Partly Falls in FR2
* Issue 4-2: Consideration of Bands for NTN above FR1

1. Topic #5: HAPS Frequency Bands

* Issue 5-1: HAPS Exemplary Frequency Band
* Issue 5-2: HAPS RF Requirements
* Issue 5-3: HAPS terminology change to HIBS
* Issue 5-4: HIBS Discussion

1. Topic #6: NTN UL frequency synchronization requirement

* Issue 6-1: UL frequency error requirement

# Topic #1: Use Cases and Deployment Scenarios

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

General RAN4 RF NTN related aspects discussions are required to decide on the way forward and to provide an initial RF core list of parameters/requirements to be considered by RAN4 RF and demodulation work. For HAPS aspects there is a dedicated topic.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Huawei, HiSilicon | **Observation 1:** In order to reduce the regulatory risk, RAN4 can start the work with a frequency band in which MSS is used without incumbent service. |
| [R4-2102173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102173.zip) | Ericsson | **Proposal 1:** The frequency ranges considered for NTN should be spectrum allocated by ITU to *Mobile satellite* as primary service.  **Proposal 2:** Spectrum allocated to Fixed satellite service should not be considered as a candidate for NTN bands.  **Proposal 3:** Investigate the ESIM use case as well as its architecture in the Fixed satellite service spectrum identified by ITU.  **Proposal 4:** NTN bands shall be either fully in FR1 or fully in FR2, but not only partly in FR1or FR2. |
| [R4-2101933](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101933.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** ITU separates spectrum for satellite and HAPS deployments in separate groups.  **Proposal 3:** RAN 4 to choose one example NR bands in FR1 belonging to satellite spectrum, identified by ITU for IMT deployment and focus on adjacent channel issues  **Proposal 4:** RF requirements for a terrestrial gNB should be used as baseline for HAPS, LEO and GEO deployments.  **Proposal 5:** Satellites in transparent deployments should provide same performance in terms of RF characteristics.  **Proposal 6:** RAN4 to discuss how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.  **Proposal 7:** RAN4 to discuss whether user movement really is needed in the studies or whether speed dependent issues can be based on the LEO case without user movement. |
| [R4-2102374](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102374.zip) | HUGHES Network Systems, Thales, Inmarsat, Intelsat, Fraunhofer, ESA | **Proposal 1:** Frequency bands allocated to satellite services above 10 GHz can be treated as FR2 band for consideration by RAN4 specification work.  **Proposal 2:** “3GPP TR 38.820: NR; 7-24 GHz frequency range” can also be used as reference.  **Proposal 3:** New band definitions for NTN operating in frequencies in FR2 or FR2-like (7-24 GHz range) shall assume NTN operating in FDD mode.  **Proposal 4:** For bands above 6 GHz, “VSAT” UE including fixed/moving platform mounted ones are considered as baseline. The RF characteristics of “VSAT” UE in Table 6.1.1.1-3 in 3GPP TR 38.821 shall be assumed in the Rel-17 WI NR-NTN-solutions. |
| [R4-2101814](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101814.zip) | Huawei, HiSilicon | **Observation 1:** We can only consider the conducted connector in the NTN specification, if parabolic/cassegrain antenna can be used for VSAT and Satellite and omnidirectional antenna is used for handheld UE. |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | CATT | **Proposal 1:** It is proposed to consider 1980-2010/2170-2200MHz for GEO satellite.  **Proposal 2:** It is proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite.  To be considered by [98e][311] NTN\_Solutions\_Part2:  **Proposal 4:** It is proposed to focus on fixed beam scenario for satellite.  **Proposal 5:** It is proposed to consider the NTN scenarios in Table 2.2-1 for co-existence study.  **Proposal 6:** It is proposed to consider Rural and Dense urban scenario with priority for terrestrial network. |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | CMCC | **Observation 1:** Once NTN band is the same as or overlapping with IMT operating band, it is possible that the satellite and IMT operate in co-channel rather than adjacent-channel as how different mobile operators have done to avoid interference. This co-channel operation would result in destructive interference and make it hard for the actual application.  **Observation 2:** it is up to RAN plenary to decide whether to study the NTN bands falling into 7-24GHz.  **Observation 6:** ITU has performed some studies so far, including the spectrum allocation, the sharing and compatibility studies and technical conditions for protection of ground-based IMT stations. But no domestic adjacent-channel co-existence study has been performed.  **Proposal 1:** It should be emphasized that the frequency ranges considered for satellite should be spectrum allocated by ITU to satellite services on a primary basis rather than secondary basis.  **Proposal 2:** at current stage L band would be more appropriate as exemplary band for NTN considering S band may introduce harmful interference for current deployed IMT network.  **Proposal 3:** it is appropriate not identifying any FR2 exemplary bands at current stage because it is hard to seek an exemplary band completely for FR2. |
| [R4-2100905](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100905.zip) | Samsung | **Proposal 1:** Prefer only 1 exemplary band for FR1 to minimize the work load of RAN4, and prefer S-band (1980-2010/2170-2200MHz) as the exemplary band.  **Proposal 2:** Deprioritize FR2 exemplary band at this stage. |
| [R4-2100487](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100487.zip) | CATT | **Proposal 1:** Treat NTN Payload + NTN GW as a single entity (repeater or relay) and focus only on the service link in RAN4 requirement development.  **Proposal 2:** Develop Repeater-type requirement for NTN in Rel-17.  **Proposal 3:** The reference point for NTN requirements and the test method need to be clarified. |
| [R4-2101859](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101859.zip) | THALES | **Proposal 6:** Based on simulation and evaluation results for described NTN-TN coexistence scenarios in adjacent bands, work may further consider relaxing some of satellite RF parameters such as satellite ACLR and ACS. |
|  |  |  |

## 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 1-1 IAB Requirements Discussion for VSAT

*Sub-topic description*

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

**Issue 1-1: IAB Requirements Discussion for VSAT**

* Proposals
  + Option 1: RAN4 to discuss how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.
* Recommended WF
  + Investigate how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.

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

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Huawei |  | In TR 38.821, VSAT is assumed as a UE instead of IAB node. It may have an impact on other working group. Perhaps, RAN4 can’t decide whether we need to discuss IAB feature for NTN. WI revision is needed.  C:\Users\z00471447\AppData\Roaming\eSpace_Desktop\UserData\z00471447\imagefiles\868BEE29-D6C9-430F-86AD-3933CE51BCC3.png |
| CATT |  | Our understanding is that VSAT is a kind of special UE. Clarifications are needed why we need to relate it to IAB? |
| CMCC |  | Share the same view with Huawei and CATT, further clarification is needed for the reason why we introduce IAB features. |
| Qualcomm | Agree | It would be good if we can reuse the IAB requirements for VSAT. |
| Eutelsat | Agree | IAB could be an interesting option in higher bands. |
| Nokia | Agree | Perhaps also repeaters should be investigated even though this WI has just started. |
| Hughes/EchoStar | Agree |  |
| ZTE |  | No quite understand how to apply IAB requirement for VSAT terminal? VSAT terminal would also work with both BS and UE capability as regenerative relay |
| Inmarsat | Partially agree | IAB could indeed be an interesting option in higher bands, but requires further clarification as to why it is more beneficial than treating as a UE and what are the implications. We agree that it is worth studying the reusability of the requirements, but should not imply that IAB is the way forward for VSAT. |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 6 companies agree
* 1 company partially agrees
* 3 companies raised some concerns and asked for:
  + Clarification with respect to similarity between VSAT (special type of UE) and IAB
  + NTN WID revision in order to be able to reuse IAB requirements (or a subset) for the VSAT Terminal type in NTN.

Moderator suggests the following modifications for WF:

**Proposal 1-1:** RAN4 to investigate how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.

*Note:* WI revision might be needed.

### Sub-topic 1-2 UE Mobility Discussion

*Sub-topic description*

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

**Issue 1-2: UE Mobility Discussion**

* Proposals:
  + Option 1: RAN4 to discuss whether user movement really is needed in the studies or whether speed dependent issues can be based on the LEO case without user movement.
  + Option 2: UE FR1 with mobility, UE outside FR1 without mobility
* Recommended WF:
  + Proposed to consider:
    - UE FR1 with mobility, UE outside FR1 without mobility

**OR**

* + - UE without mobility for coexistence analysis.
  + Continue discussion in [98e][311] NTN\_Solutions\_Part2 for coexistence scenarios.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes.  In both FR1 and outside FR1, UE mobility shall be considered. However, for coexistence studies, Option 2 may be prioritized. |
| MediaTek | Yes. UE mobility is negligible compared to LEO satellite speed and coverage time. UE mobility may be de-prioritised. |  |
| Ericsson | Would that mean GEO is out of scope then? | This wording looks over confusing. Of course, we shall consider mobility in RAN4, there is no alternative to this.  But, if the question was if mobility should be considered or not in the coexistence studies, this would need further consideration: our coexistence simulations are static indeed but this is based on the fact moblity is considered via a random distribution of the UEs, considering BS are static and UEs are mobile. For LEO satellite, this would then need further thinking… |
| Huawei | A number of service scenarios as described in TS 22.261 (e.g. user in residential homes, in vehicles, in **high speed trains or on board airplanes**). I’m not sure we can ignore the UE mobility in RAN4 | RF adjacent channel coexistence simulations are static, but it doesn’t mean we can ignore the UE mobility. |
| CATT | Why the UE movement issue needs to be coupled with the satellite type? | For RF co-existence study, UE movement might not be so necessary since the simulation is snapshot based static simulation. |
| CMCC |  | Adjacent channel co-existence simulation is static without reflecting UE movement behavior. Further clarification is needed to help make sure how to reflect UE movement in the simulation and the possible impact to the simulation. From our point of view, UE movement may have no impact on co-existence simulation. |
| Qualcomm |  | RAN4 should consider the UE mobility for both FR1 and frequencies above FR1. For co-existence study, no need to consider UE mobility since static Monto Carlo approach is used. |
| Eutelsat |  | For FR1 co-existence studies (ACLR/ ACS) we should assume quasi-static UE (Monte Carlo). ‘Movement’ will need to be included into the link budget assumptions. |
| Nokia | Yes. The relative UE-Satellite mobility is more important, i.e. the impact of the very high speed LEO satellite. This is valid for both FR1 and outside FR1. |  |
| Hughes/EchoStar |  | Yes, UE mobility shall be considered |
| Inmarsat | UE mobility should have no bearing to satellite architecture and should always be taken into account.  If there are good reasons to neglect UE mobility at both GEO and NGSO, we would like to hear them. | UE mobility should be considered for both FR1 and above-FR1. Whether UE mobility is critical or not for co-existence study largely depends on the type of co-existence considered (and the scope – i.e. NTN-TN or NTN-NTN) and on the type of UE. |
| Intelsat |  | Prioritize FR1 with mobility, but include outside FR1 with mobility. Coexistence studies should be considered separately. |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Samsung | Partially | OK with “UE without mobility for coexistence analysis.” |
| MediaTek | Partially agree | Prefer “UE without mobility for coexistence analysis.” |
| Ericsson | Disagree | Mobility should be part of the initial NTN considerations |
| Huawei | Disagree | RF adjacent channel coexistence simulations are static. We can’t confuse the concept of static simulation and UE mobility. |
| CATT | Disagree | UE movement might not be necessary for RF co-existence study. |
| CMCC | Disagree | Further clarification is needed to help make sure how to reflect UE movement in the simulation and the possible impact to the simulation. |
| Qualcomm | Partially | Fine with UE without mobility for coexistence analysis. But for other discussion, UE mobility should be considered for all possible frequency ranges. |
| Nokia | Partially agree | We do not really understand how mobility aspects are coupled with coexistence analysis |
| Hughes/EchoStar | Partially | OK with UE with mobility for coexistence for FR1. UE mobility should be considered for all possible frequency ranges. |
| ZTE | Partially | For UE outside of FR1, then without mobility, it seems want to preclude LEO and moving beam for frequency range outside of FR1, we need more clarifications on that.  For coexistence study, UE mobility is not so important. |
| Inmarsat | Disagree | UE mobility may not be necessary for RF co-existence study, depending on the study methodology and scenario assumptions. Co-existence study assumptions should be defined first. |
| Intelsat |  | Coexistence studies should be considered separately |
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Proposed WF with respect to sources:

* 1 companies agrees
* 6 company partially agree
* 5 companies raised some concerns

Moderator suggests the following modifications for WF:

**Proposal 1-2:** RAN4 may consider UE without mobility for NTN coexistence analysis.

**Proposal 1-3:** Further continue discussion with respect to UE mobility assumptions in the RAN4 NTN coexistence studies.

### Sub-topic 1-3 FSS and ESIM

*Sub-topic description:*

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

**Issue 1-3: FSS and ESIM**

* Proposals:
  + Option 1: Spectrum allocated to **Fixed** satellite service shall **not be** considered as a candidate for NTN bands, only spectrum allocated to Mobile satellite as primary service shall be considered.
* Investigate the ESIM use case as well as its architecture in the Fixed satellite service spectrum identified by ITU.
  + Option 2: Spectrum allocated to **Fixed** satellite as primary service **should be** considered as a candidate for NTN bands.
* Investigate the ESIM use case as well as its architecture in the Fixed satellite service spectrum identified by ITU.
  + Option 3: Spectrum allocated to FSS **and MSS** as primary service **shall be** considered as a candidate for NTN bands.
* Investigate the ESIM use case as well as its architecture in the Fixed satellite service spectrum identified by ITU.
* Recommended WF:
  + Investigate the ESIM use case as well as its architecture in the FSS spectrum identified by ITU.
  + Decide if FSS as primary service should be considered as a candidate for NTN bands.
  + *Note:* According to WRC-19, ESIM operate in FSS bands: “Earth stations in motion (ESIM) are earth stations that communicate with geostationary-satellite orbit (GSO) systems operating in the fixed-satellite service (FSS) and operate on platforms in motion in the frequency ranges 17.7-20.2 GHz and 27.5-30 GHz.”, <https://www.itu.int/en/mediacentre/backgrounders/Pages/Earth-stations-in-motion-satellite-issues.aspx>

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | No |  | Yes |
| Ericsson | Agree | No, RAN is only dealing with Mobile service, not Fixed service so, by default, any spectrum allocated to FSS as primary shall not be a NTN candidate band. | No, RAN is only dealing with Mobile service, not Fixed service so, by default, any spectrum allocated to FSS as primary shall not be a NTN candidate band. |
| Huawei | Agree | No, share the same view with Ericsson.  Besides, sharing and compatibility between ESIM with non-GSO FSS systems and other primary services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (s-e) and 27.5-29.1 GHz, 29.5-30.0 GHz (e-s) in the fixed satellite service are still under study in WRC-23. Before ITU complete the study, 3GPP can’t consider the ESIM case in order to reduce the regulatory risks. | No, share the same view with Ericsson.  Besides, sharing and compatibility between ESIM with non-GSO FSS systems and other primary services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (s-e) and 27.5-29.1 GHz, 29.5-30.0 GHz (e-s) in the fixed satellite service are still under study in WRC-23. Before ITU complete the study, 3GPP can’t consider the ESIM case in order to reduce the regulatory risks. |
| CATT |  |  | Fine to have further study.  Proposal to change “shall be” to “could be” and have some further discussion. |
| Eutelsat |  |  | Subject to further study. |
| Nokia | Yes |  |  |
| Hughes/EchoStar |  |  | Yes Option 3 |
| Inmarsat | Disagree | Agree | Agree – Option 3 captures best what is required.   As WF Note rightly points out: Earth stations in motion (ESIM) are earth stations that communicate with geostationary-satellite orbit (GSO) systems operating in the fixed-satellite service (FSS) and operate on platforms in motion in the frequency ranges 17.7-20.2 GHz and 27.5-30 GHz  Therefore are absolutely in scope for NTN. 3GPP should not try to do the work of ITU or WRC. |
| Intelsat | No |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Ericsson | Partially | As commented, FSS spectrum can not be a NTN candidate band. But we agree ESIM should be further investigated and, if acceptable, only spectrum allocated to ESIM might be considered, but not any FSS spectrum. |
| Huawei | Disagree | Sharing and compatibility between ESIM with non-GSO FSS systems and other primary services in the frequency bands 17.7-18.6 GHz, 18.8-19.3 GHz and 19.7-20.2 GHz (s-e) and 27.5-29.1 GHz, 29.5-30.0 GHz (e-s) in the fixed satellite service are still under study in WRC-23. Before ITU complete the study, 3GPP can’t consider the ESIM case in order to reduce the regulatory risks. |
| CATT |  | We propose to select a FR1 band and a FR2 band. Given the spectrum situation, Ka Band might be a possible example band from developing 5G verticals point of view. Given the workload Ka band can be considered with low priority. |
| Panasonic | Agree |  |
| Nokia | Partially agree | As indicated option 1 should be the starting point. However, we are fine to investigate the ESIM use case further. Based on this investigation ITU designated spectrum might be considered. |
| Hughes/EchoStar | Partially | FSS and MSS as primary service should be considered as a candidate for NTN bands. As identified by ITU - FSS includes VSAT and ESIM. Both already included in the study TR38.821 as UE with external antenna (fixed and on moving platform). RP-202908, updated NTN WID |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 3 companies agree
* 3 company partially agree
* 1 company disagrees

Moderator suggests the following modifications for WF:

**Proposal 1-4:** RAN4 shall investigate the ESIM use case as well as its architecture in the FSS spectrum identified by ITU.

### Sub-topic 1-4 UE-Type assumptions for FR1

*Sub-topic description: Candidate options from RAN4#97e (please see R4-2017600)*

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

**Issue 1-4: UE-Type assumptions for FR1**

* Proposals
  + Option 1: At least for FR1, RAN4 shall consider Handheld UE & VSAT UE with described characteristics:
    - Handheld: Omnidirectional antenna, 500 km/h (e.g. on board a high speed train), Linear: +/-45°X-pol, up to 200 mW (UE power class 3)
    - VSAT: Directive antenna (up to 60 cm equivalent aperture diameter), Up to 1200 km/h (e.g. mounted UE on a building or moving platforms, e.g., aircrafts, trains, vessels or vehicles. Examples of such UE can be **ESIM and** VSAT), Circular polarisation, up to 20 W Tx power.
  + Option 2: At least for FR1, RAN4 shall consider Handheld UE & VSAT UE with described characteristics:
    - Handheld: Omnidirectional antenna, 500 km/h (e.g. on board a high speed train), Linear: +/-45°X-pol, up to 200 mW (UE power class 3)
    - VSAT: Directive antenna (up to 60 cm equivalent aperture diameter), Up to 1200 km/h (e.g. mounted UE on a building or moving platforms, e.g., aircrafts, trains, vessels or vehicles. Examples of such UE can be VSAT), Circular polarisation, up to 20 W Tx power.
* Recommended WF:
  + **Follow RP-202908, updated NTN WID:** “As per TR 38.821, it shall be assumed that handheld devices in FR1 and “VSAT” devices with external antenna (including fixed and moving platform mounted devices) can be considered for NTN for the RAN1-3 specifications.”

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes  For FR1, handheld could be prioritized. |  |
| MediaTek | No. Handheld UE on high speed train is not the main use case for NR NTN. Low mobility UE scenario should be the main focus. We suggest deleting UE mobility requirements, as this is addressed in section 1.2.2. | No. Handheld UE on high speed train is not the main use case for NR NTN. Low mobility UE scenario should be the main focus. We suggest deleting UE mobility requirements, as this is addressed in section 1.2.2. |
| Ericsson | Let’s first further investigate ESIM use case | Ok |
| Huawei | In RP-202907, only Handheld devices in FR1 and “VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported. We don’t need to change and discuss this principle. | We can follow the principle in RP-202907 as a start point. |
| CATT | Further study on ESIM use case. |  |
| Eutelsat | Yes |  |
| Hughes/EchoStar | Agree with Option 1 |  |
| ZTE | Yes |  |
| Inmarsat | We agree in principle as a starting point. However VSAT/ESIM should also include FR2 as per RP-202907. | No |
| Intelsat | Yes  VSAT and Handheld may be prioritized |  |
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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** |
| THALES | Agree |  |
| Samsung | Agree | OK with Prioritizing handheld UE in FR1.  Detailed characteristics will be discussed and determined in [311] |
| Mediatek | Partially agree | We suggest deleting UE mobility requirements from this section, as this is already addressed in section 1.2.2. |
| Ericsson | Agree |  |
| Huawei | Partially agree |  |
| CATT | Agree. |  |
| Qualcomm | Agree |  |
| Panasonic | Agree |  |
| Eutelsat | Agree | For FR1 UE with omnidirectional / non-directional antenna. |
| Nokia | Partially agree | We are in principal fine to consider both VSAT and ESIM with the latter being dependent in Issue 1-3. It seems this is the only difference in the listed options. One thing needed is to clarify the Tx power levels (EIRP) expected by both VSAT and ESIM deployments. |
| Hughes/EchoStar | Agree | RP-202908, updated NTN WID |
| Inmarsat | Partially Agree | Suggested change (in **bold**):  “[…]handheld devices in FR1 and “VSAT” devices with external antenna (including fixed and moving platform mounted devices) **in FR1 and FR2** can be considered for NTN for the RAN1-3 specifications.” |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 9 companies agree
* 4 company partially agree

Moderator suggests the following modifications for WF:

**Proposal 1-5:** RAN4 shall follow the following recommendations as already adopted in the updated NTN WID **RP-202908:**

* Handheld devices in FR1 are supported (e.g. Power class 3)
* “VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. “VSAT” characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.

**Proposal 1-6:** For RAN4 NTN coexistence studies in FR1, handheld devices could be prioritized (to be further discussed in the NTN coexistence analysis).

### Sub-topic 1-5 UE-Type assumptions for outside FR1

*Sub-topic description*

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

**Issue 1-5: UE-Type assumptions for outside FR1**

* Proposals:
  + Option 1: For bands above 6 GHz, “VSAT” UE including fixed/moving platform mounted ones are considered as baseline. The RF characteristics of “VSAT” UE in Table 6.1.1.1-3 in 3GPP TR 38.821 shall be assumed in the Rel-17 WI NR-NTN-solutions.
* Recommended WF:
  + **Follow RP-202908, updated NTN WID:** ““VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. “VSAT” characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.”

**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** |
| THALES | Agree |  |
| Samsung | Agree |  |
| Ericsson | Partially agree | RF characteristics are FFS. UEs in fixed platforms should not be considered at this point in RAN4 |
| Huawei | Disagree | I suppose the contents in Table 6.1.1.1-3 in 3GPP TR 38.821 are just assumptions for simulation instead of RF characteristics. |
| CATT |  | RF characteristics needs further study in RAN4. |
| Qualcomm | Agree |  |
| Panasonic | Agree |  |
| Eutelsat |  | Given different RF characteristics, FR2 require further study. |
| Nokia | Partially agree | We are fine for assumption for outside FR1. For FR1 we would like to prioritize UE hand-held. |
| Hughes/EchoStar | Agree | Follow RP-202908, updated NTN WID |
| Inmarsat | Agree |  |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 7 companies agree
* 2 company partially agree
* 1 company disagrees with comments

Moderator suggests the following modifications for WF:

**Proposal 1-5:** RAN4 shall follow the following recommendations as already adopted in the updated NTN WID **RP-202908:**

* Handheld devices in FR1 are supported (e.g. Power class 3)
* “VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. “VSAT” characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.

**Proposal 1-7:** For bands above 6 GHz, “VSAT” UE including fixed/moving platform mounted ones are considered as baseline.

### Sub-topic 1-6 Few Other Topics/Leftovers from RAN4#97e

*Sub-topic description*

* *See R4-2017600 for reference, with proposed way forward based on the outcomes of “Email discussion summary for [97e][312] NTN\_Solutions”*
* *See proposals with “orange” comments (marked as not agreeable in RAN4#97e), but identified as potential for “agreed with changes” (for GW session or future meeting).*

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

**Issue 1-6: FR1 exemplary frequency band**

* Proposals
  + Option 1: At least one exemplary frequency band per FR1 should be defined for satellite.
  + Option 2: Only one exemplary frequency band per FR1 should be defined for satellite.
* Recommended WF
  + We can consider “only” for exemplary band used for coexistence scenario, and then later on (if sufficient resources) include other bands through normal process for additional NR band inclusion.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes |
| MediaTek |  | Yes |
| Ericsson | We can’t work on many bands, the topic is already complex enough.. | Ok |
| Huawei | Considering the workload and complexity in this topic, option 1 is excluded. | OK |
| CATT | Both FR1 and FR2 need to be considered. FR1 could be prioritized over FR2 given the complexity and workload. | OK |
| CMCC | Considering the workload, one exemplary band is enough. | OK |
| Qualcomm |  | Yes |
| Eutelsat |  | Yes |
| Nokia |  | Yes |
| Hughes/EchoStar |  | Yes |
| ZTE | The NTN work load is expected to larger than Rel-15 already. | Okay |
| Inmarsat |  | Yes |
| Intelsat |  | Yes if FR1 exemplary band is not a MSS, otherwise there should be at least one non-MSS exemplary band |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Samsung | Agree |  |
| Mediatek | Agree |  |
| Ericsson | Partially agree see comment | New band shall be introduce via separate WI, as we usually do for any band in RAN4. |
| CATT | Partially agree | If we only focus on FR1 band for the time being, I am not sure FR2 band can be done in a straight forward way as usually done for other bands. A general WI with example band might be the feasible approach. |
| CMCC | Agree |  |
| Qualcomm | Agree |  |
| Panasonic | Agree |  |
| Eutelsat | Agree |  |
| Hughes/EchoStar | Agree |  |
| Inmarsat | Agree |  |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 10 companies agree
* 2 company partially agree

Moderator suggests the following modifications for WF:

**Proposal 1-8:** RAN4 shall define only one FR1 exemplary frequency band for NTN coexistence studies.

*Note:* RAN4 shall continue discussion for (potential) above FR1 exemplary band.

**Issue 1-7: Inclusion of additional NR bands**

* Proposals
  + Option 1: Although RAN4 will select exemplary band(s) in the current NR-NTN-solutions WI, the definition of additional NR bands for satellite will be part of dedicated RAN4 led Release-17 work items.
  + Option 2: Although RAN4 will select exemplary band(s) in the current NR-NTN-solutions WI, the definition of additional NR bands for satellite can be part of dedicated RAN4 led work items based on TSG-RAN’s decision.
* Recommended WF
  + **Proceed as endorsed by chairman in RP-202907:** More “satellite” bands for NTN use can be proposed in RAN4 as long as its intended usage is compliant with radio regulations via separate “satellite” band specific WIs once progress on generic and core requirements is considered sufficient by RAN4.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes, with the condition:   * that Option 1 does not exclude the selection of an exemplary NTN band outside FR1, and * that the recommended WF applies beyond the selection of exemplary bands. | Yes, with the condition:  - that Option 2 does not exclude the selection of an exemplary NTN band outside FR1, and  - that the recommended WF applies beyond the selection of exemplary bands. |
| Ericsson | No, we don’t know in which Release a band could be introduced  This WI should develop generic requirements and band specific requirements for one band. Future WIs can add future bands. | This is a very strange option: which selection RAN4 is doing? There is no bands list in the WI… |
| Huawei | Seems we don’t need to discuss the future WI in RAN4. | Considering the progress in this topic, please focus on this WI. |
| CATT | It’s not possible to set up a parallel RAN4 dedicated Band WI with the general WI ongoing in the same release. Propose to focus on developing general requirement using the selected example band (s). | No need to duplicate the discussion for this option. |
| Qualcomm | Does it mean the frequency outside the FR1 is out of the current WI scope? Note that it is not possible to have other dedicated NTN band WIs before this WI is completed?  The better way is RAN4 to prioritize FR1 but not preclude the frequencies outside FR1 (can be set as low priority) |  |
| Eutelsat | Yes for FR1 band. | Yes for FR1 band |
| Nokia | No – modifications of WIDs is a RAN discussion | Yes |
| Hughes/EchoStar | Agree with Option 1 and recommended WF |  |
| Intelsat | Yes  The consideration for a NTN band outside FR1 should not be precluded |  |
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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** |
| THALES | Partially agree | With the condition that the recommended WF applies beyond the selection of exemplary bands. |
| MediaTek | Agree |  |
| Ericsson | Agree |  |
| Huawei | Partially agree | In RAN4, we don’t need to spend time on what RAN plenary has agreed or modifying anything. |
| CATT | Agree |  |
| Qualcomm | Partially agree | The better way is RAN4 to prioritize FR1 but not preclude the frequencies outside FR1 (can be set as low priority) in the current WI. |
| Panasonic | Agree |  |
| Nokia | Partially agree | Adding bands based on operator requests and regional requirements are normal practice in RAN4 but a WI should be approved at RAN before such work can commence. |
| Hughes/EchoStar | Agree |  |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 6 companies agree
* 4 company partially agree with comments

Moderator suggests the following modifications for WF:

**Proposal 1-9:** RAN4 shall proceed as endorsed by RAN chairman in RP-202907: more “satellite” bands for NTN use can be proposed in RAN4 as long as its intended usage is compliant with radio regulations via separate “satellite” band specific WIs once progress on generic and core requirements is considered sufficient by RAN4.

*Note:* WI should be approved at RAN before such work can commence.

**Issue 1-8: TN BS/UE ACLR & ACS parameters**

* Proposals
  + Option 1: RAN4 should further discuss and decide ACS & ACLR requirements to be considered for TN in the coexistence study with NTN, depending on FR and BW configuration.
  + Option 2: For the purpose of simulations for the coexistence study between TN & NTN, the TN BS/UE ACLR & ACS parameters need to be further discussed. It may depend on FR and BW configuration.
* Recommended WF
  + Further discuss Option 2 in [98e][311] NTN\_Solutions\_Part2.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes |
| Ericsson | No, there shall be no impact on TN UE/BS requirements. This was already discussed and agreed in RAN. | No, they are all specified in existing TS. This was already discussed and agreed in RAN. |
| Huawei | No, in agreed WF R4-2017600, NTN RF requirements shall be specified assuming no impact on TN RF requirements. We don’t need to discuss the agreement which was reached in last meeting. | No, the legacy networks have been deployed in the field. How can we change the requiremens. |
| CATT | Stick to the agreement in the last RAN4 meeting. No impact to TN ACLR and ACS requirement. | Stick to the agreement in the last RAN4 meeting. No impact to TN ACLR and ACS requirement. |
| CMCC | NTN RF requirements shall be specified without impact to TN RF requirements | NTN RF requirements shall be specified without impact to TN RF requirements |
| Qualcomm | No change for legacy requirements was the consensus in RAN4 | No change for legacy requirements was the consensus in RAN4 |
| Eutelsat |  | Yes for FR1. FR2 raises other concerns and requires study. |
| Hughes/EchoStar |  | OK |
| DISH | No, there shall be no impacts to TN UE/BS requirements | No, there shall be no impacts to TN UE/BS requirements |
| ZTE | As agreed in last meeting, TN requirement should not be changed due to the introduction of NTN network. | As agreed in last meeting, TN requirement should not be changed due to the introduction of NTN network. |
| Intelsat |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| MediaTek | Agree |  |
| Ericsson | Disagree | BS/UE ACLR and ACS for TN shall be the ones specified in TS 38.104, 38.101-1 and 30.101-2. |
| Huawei | Disagree | We don’t need to discuss the agreement which was reached in last meeting. |
| CATT | Disagree | Prefer not to reopen the same discussion. |
| CMCC | Disagree | No need for the discussion |
| Qualcomm | Agree |  |
| Eutelsat | Agree |  |
| Nokia | Disagree | BS and UE specifications shall be used as agreed in RAN |
| Hughes/EchoStar | Agree |  |
| DISH | Disagree | No need to even discuss, TN BS/UE ACLR and ACS shall be as per TS38.104/TS38.101 |
| ZTE | Disagree |  |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 6 companies agree
* 7 company disagree with comments

Moderator kindly recalls that no agreement was reached on this subject in [97e][312]. Option 2 was marked with “orange”. Moderator suggests the following modifications for the WF:

**Proposal 1-10:** RAN4 shall use for NTN coexistence studies TN BS/UE ACLR and TN ACS as the ones specified in TS 38.104, 38.101-1 and 30.101-2.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Please see above |

### 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.*

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| --- | --- |
| **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.*

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| --- | --- |
|  | **Status summary** |
| **Issue 1-1:** IAB Requirements Discussion for VSAT | Proposed WF with respect to sources:   * 6 companies agree * 1 company partially agrees * 3 companies raised some concerns and asked for:   + Clarification with respect to similarity between VSAT (special type of UE) and IAB   + NTN WID revision in order to be able to reuse IAB requirements (or a subset) for the VSAT Terminal type in NTN.   *Tentative agreements:*  **Proposal 1-1:** RAN4 to investigate how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.  *Note:* WI revision might be needed.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-2:**  UE Mobility Discussion | Proposed WF with respect to sources:   * 1 companies agrees * 6 company partially agree * 5 companies raised some concerns   *Tentative agreements:*  **Proposal 1-2:** RAN4 may consider UE without mobility for NTN coexistence analysis.  **Proposal 1-3:** Further continue discussion with respect to UE mobility assumptions in the RAN4 NTN coexistence studies.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-3:** FSS and ESIM | Proposed WF with respect to sources:   * 3 companies agree * 3 company partially agree * 1 company disagrees   *Tentative agreements:*  **Proposal 1-4:** RAN4 shall investigate the ESIM use case as well as its architecture in the FSS spectrum identified by ITU.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-4:** UE-Type assumptions for FR1 | Proposed WF with respect to sources:   * 9 companies agree * 4 company partially agree   *Tentative agreements:*  **Proposal 1-5:** RAN4 shall follow the following recommendations as already adopted in the updated NTN WID **RP-202908:**   * Handheld devices in FR1 are supported (e.g. Power class 3) * “VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. “VSAT” characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.   **Proposal 1-6:** For RAN4 NTN coexistence studies in FR1, handheld devices could be prioritized (to be further discussed in the NTN coexistence analysis).  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-5:** UE-Type assumptions for outside FR1 | Proposed WF with respect to sources:   * 7 companies agree * 2 company partially agree * 1 company disagrees with comments   *Tentative agreements:*  **Proposal 1-5 [similar to Issue 1-4]:** RAN4 shall follow the following recommendations as already adopted in the updated NTN WID **RP-202908:**   * Handheld devices in FR1 are supported (e.g. Power class 3) * “VSAT” devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. “VSAT” characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.   **Proposal 1-7:** For bands above 6 GHz, “VSAT” UE including fixed/moving platform mounted ones are considered as baseline.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-6:** FR1 exemplary frequency band | Proposed WF with respect to sources:   * 10 companies agree * 2 company partially agree   *Tentative agreements:*  **Proposal 1-8:** RAN4 shall define only one FR1 exemplary frequency band for NTN coexistence studies.  *Note:* RAN4 shall continue discussion for (potential) above FR1 exemplary band.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-7:** Satellite constellation | Proposed WF with respect to sources:   * 6 companies agree * 4 company partially agree with comments   *Tentative agreements:*  **Proposal 1-9:** RAN4 shall proceed as endorsed by RAN chairman in RP-202907: more “satellite” bands for NTN use can be proposed in RAN4 as long as its intended usage is compliant with radio regulations via separate “satellite” band specific WIs once progress on generic and core requirements is considered sufficient by RAN4.  *Note:* WI should be approved at RAN before such work can commence.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 1-8:**  TN BS/UE ACLR & ACS parameters | Proposed WF with respect to sources:   * 6 companies agree * 7 company disagree with comments   Moderator kindly recalls that no agreement was reached on this subject in [97e][312]. Option 2 was marked with “**orange**”.  *Tentative agreements:*  **Proposal 1-10:** RAN4 shall use for NTN coexistence studies TN BS/UE ACLR and TN ACS as the ones specified in TS 38.104, 38.101-1 and 30.101-2.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
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*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **TDoc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: RAN4 NTN Architecture

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2102175](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102175.zip) | Ericsson | **Proposal 1:** RAN4 should handle gateway + satellite as a repeater or relay and specify needed requirements for gateway + satellite in a new repeater or relay specification. |
| [R4-2101933](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101933.zip) | Nokia, Nokia Shanghai Bell | **Proposal 4:** RF requirements for a terrestrial gNB should be used as baseline for HAPS, LEO and GEO deployments.  **Proposal 5:** Satellites in transparent deployments should provide same performance in terms of RF characteristics.  **Proposal 6:** RAN4 to discuss how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN. |
| [R4-2101814](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101814.zip) | Huawei, HiSilicon | Network for NTN  **Proposal 1:** RAN4 should consider (satellite + feeder link + gateway) as a NTN entity in Rel-17 from RF perspective. The corresponding UE and satellite RF requirements should be specified.  **Observation 1:** We can only consider the conducted connector in the NTN specification, if parabolic/cassegrain antenna can be used for VSAT and Satellite and omnidirectional antenna is used for handheld UE. |
| [R4-2100111](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100111.zip) | THALES | **Proposal 1:** The following aspects should be considered out of scope of 3GPP since they are implementation dependent:   * The fronthaul interface between the NTN-gateway and the gNB-DU. It is similar to the interface between gNB-DU and RRH. It may be a wire-line connection (e.g. Optical fibre, Ethernet cable, RF cable, ..). * The NTN vehicle may be specific to each NTN infrastructure. * The NTN-Gateway, which is a transport node (RAN3 agreement). * The feeder link, which is transporting the NR-Uu interface. * The NTN control function to control the NTN-vehicle(s) as well as the radio resources of the NTN payload(s).   **Proposal 2:** As part of the Rel-17 WI NR-NTN-solutions, 3GPP RAN4 should focus its work on the RF requirements at the service link level of the gNB including the NTN-RRH |
| [R4-2100487](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100487.zip) | CATT | **Proposal 1:** Treat NTN Payload + NTN GW as a single entity (repeater or relay) and focus only on the service link in RAN4 requirement development.  **Proposal 2:** Develop Repeater-type requirement for NTN in Rel-17.  **Proposal 3:** The reference point for NTN requirements and the test method need to be clarified. |
| [R4-2101859](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101859.zip) | THALES | **Proposal 6:** Based on simulation and evaluation results for described NTN-TN coexistence scenarios in adjacent bands, work may further consider relaxing some of satellite RF parameters such as satellite ACLR and ACS.    NTN SNR ISO curves in DL for Multiple Cells |
| [R4-2102176](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102176.zip) | Ericsson | It should be noted that at least for FR1 where gateway can interface the gNB, conducted type of requirements can be used while for access part i.e. when satellite interfaces the UE, there is a need to develop proper OTA requirements.  In this contribution, a brief overview of requirement structure based on proposed approach i.e. handling gateway+ satellite as either repeater or relay was discussed.  As relay requirements are more comprehensive, if there is additional processing occurs within either gateway or satellite, using the relay is to prefer. It is essential to conclude on how to handle the gateway + satellite to progress further work. |

## 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 Satellite-FeederLink-Gateway Component Discussion

*Sub-topic description:*

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

**Issue 2-1: Satellite-FeederLink-Gateway Component**

* Proposals:
  + Option 1: RAN4 should consider (satellite + feeder link + gateway) as a single NTN entity in Rel-17 from RF perspective.
  + Option 2: RAN4 should consider the NG-RAN as including (NTN payload + feeder link + NTN gateway + gNB) in Rel-17.
* Recommended WF:
  + Further discuss & decide the NTN entity to be considered from RF perspective.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | No  NTN-GW interface should not be specified. It has also been decided in RAN3 that NTN-Gateway is a transport node and out of scope of 3GPP in Rel-17. | Yes |
| Ericsson | Yes | No, for the reasons given in our contribution |
| Huawei | Yes | In our understanding, the partial function in gNB is integrated in the gateway, even if they have different names. |
| CATT | Both options need further study. If using option 1, Repeater-type requirement will be needed. The problem is that there is no interface defined between NTN gateway and gNB. | Both options need further study. If using option 2, then BS-type requirement will be needed. |
| Eutelsat |  | Yes |
| Nokia | Yes | No. An NTN entity has to be clearly defined and separated from NG.RAN in terms of radio functionalities. |
| Hughes/EchoStar | Possible  Bear in mind that each satellite connects to multiple gateways | Agree  Also bear in mind that each satellite connects to multiple gateways |
| ZTE | Before discussing option 1and option 2, then we need some discussion on whether gNB and gateway is cable connected, if yes, we think gNB could be removed from RF requirement definition, then Option 1 is more preferred |  |
| Intelsat |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree | Please see the current proposed architecture update: |
|  |  |  |
| Ericsson | NA |  |
| Huawei | Agree | Further discussion is needed. |
| CATT | Agree | Further discussion is needed. |
| Eutelsat | Agree | Agree with Thales architecture (see also discussions in RAN2/3). |
| Hughes/EchoStar | Agree | Should also align with agreement in RAN2 and RAN3 |
| ZTE |  | we need some discussion on whether gNB and gateway is cable connected, if yes, we think gNB could be removed from RF requirement definition. |
| Intelsat | Agree | Agree with the proposed architecture update noted by Thales |
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Proposed WF with respect to sources:

* 7 companies agrees
* 1 company seems to disagree (NA)

Please also note that each satellite may connect to multiple gateways, and that each gateway can connect with multiple satellites. Moderator suggests continuing discussion for the (potential) WF(s):

**Proposal 2-1:** RAN4 shall continue discussion on whether or not NTN-GW and gNB are wire-line connected (e.g. through Optical fibre, Ethernet cable, RF cable,..).

**Proposal 2-2:** RAN4 shall continue discussion on the NTN architecture to be used.

*Note:* the figure below may be used as example and modified accordingly



**Some other suggested proposals, not to be discussed in the meeting (at least not for the 1st round):**

**I2a)** RAN4 shall continue discussion to investigate if NTN-Gateway allows a Mobile Termination.

*Note:* According to RAN3 agreement, NTN-Gateway is a transport node and should not be specified. Therefore, NTN-Gateway is not (necessary) supporting a MT.

**I2b)** RAN4 shall continue discussion to investigate if introducing a Mobile Termination in the NTN-Gateway may induce non-deterministic latency between NTN-Gateway and gNB, which may affect UE time and frequency synchronisation on the service link.

**I2c)** RAN4 shall continue discussion to investigate if NTN RRM requirements may be affected when introducing a wireless connection between NTN-Gateway and gNB.

*Note:* An RF link between the NTN-GW and gNB may affect (at least) the assumptions considered by RAN1 for NTN time and frequency synchronization.

**Ericsson asked to remove proposals I2a), I2b), I2c) and therefore they will not be considered for the 1st round.**

**Issue 2-2: Satellite-FeederLink-Gateway Component Type**

* Proposals:
  + Option 1: The entity (NTN Payload-FeederLink-NTN Gateway) can be considered as a Relay
  + Option 2: The entity (NTN Payload-FeederLink-NTN Gateway) can be considered as a Repeater
  + Option 3: The entity (NTN Payload-FeederLink-NTN Gateway) can be considered as a Remote Radio System
* Recommended WF:
  + Further discuss differences between Repeater/Relay/Remote Radio System (e.g. regenerative/non-regenerative; RF interfaces to be considered).
  + *Moderator Note:* For example, relay uses a regenerative-like architecture while repeater is following more a non-regenerative type of architecture (with more requirements) and therefore may not be adapted for Release-17 which considers only transparent satellites (i.e. non-regenerative architecture).
  + Whatever option, RAN4 to specify only Service Link requirements.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | No, because the interface between the NTN-GW and the Non-RF gNB functions is neither radiated nor conducted RF carrier.  Moreover, NTN-GW should not be specified (as decided by RAN3), and this architecture assumes a MT in the NTN-GW, which should not be the case. | No, because the interface between the NTN-GW and the Non-RF gNB functions is neither radiated nor conducted RF carrier.  Moreover, the wireless connection between NTN-GW and gNB may also have additional RRM impacts. | Yes  It would be the easiest way to proceed in Rel-17. |
| Ericsson | OK | Ok | No, that would mean option 2 in issue 2-1 |
| Huawei | No, in my opinion the partial function in gNB is integrated in the gateway. Relay or repeater is not needed. | No, in my opinion the partial function in gNB is integrated in the gateway. Relay or repeater is not needed. | No, we can leave it to implementation. We don’t need to indicate it specifically. |
| CATT | Need further study | Need further study | Need further study |
| Eutelsat | No – agree with Thales | No – agree with Thales | Yes |
| Hughes/EchoStar | As long as it is a representative of transparent function of the satellite | | |
| ZTE | We need to discuss how to connect the Gateway and gNB firstly, then come back to this option s | We need to discuss how to connect the Gateway and gNB firstly, then come back to this option s | We need to discuss how to connect the Gateway and gNB firstly, then come back to this option s |
| Intelsat |  |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree | Whatever option, RAN4 to specify only Service Link requirements. |
| Ericsson | Disagree | If relay or repeater is chosen, the interface with gNB shall also be specified. If not, there won’t be any relay… |
| Huawei | Agree | We can just normalize the service link requirements from RF perspective. |
| CATT | Disagree | Highly depends on the conclusion for issue 2-1. |
| Eutelsat | Agree | Service link only requires a RAN4 specifaction. |
| Nokia | Partially agree | To ensure performance at the UE from the service link, requirements needs to be specified also for the serving gNB if NTN note is repeater/relay. |
| Hughes/EchoStar | Agree |  |
| ZTE |  | We need to discuss how to connect the Gateway and gNB firstly, then come back to this options |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 5 companies agree
* 2 company partially agree
* 2 companies disagree with comments

It is further required to fully understand the impact of introducing a Relay-like or Repeater-like architecture in NTN in Rel-17. Moderator suggests continuing discussion for the (potential) WF(s):

**Proposal 2-6:** RAN4 shall continue discussion to investigate if (NTN Payload-FeederLink-NTN Gateway) as a Relay is contradictory with transparent satellite assumption in Rel-17.

**Proposal 2-7:** RAN4 shall normalize the service link requirements from RF perspective. The corresponding UE and satellite RF requirements shall be specified.

**Some other suggested proposals not to be discussed in the meeting (at least not for the 1st round):**

**I2d)** RAN4 shall consider the interface between NTN-Gateway and gNB as implementation issue, and does not need to specify this interface in Rel-17.

**I2e)** RAN4 shall not normalize NTN-Gateway - gNB link from RF perspective.

**Ericsson asked to remove proposals d), e) and therefore they will not be considered for the 1st round.**

### Sub-topic 2-2 BS Requirement

*Sub-topic description*

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

**Issue 2-3: BS requirements for NTN (as for Rel-17)**

* Proposals:
  + Option 1: BS requirements at satellite RF
  + Option 2: BS requirements at the ground gNB RF
  + Option 3: BS requirements at both satellite RF and the ground gNB RF
* Recommended WF:
  + Consider at least BS requirements for satellite RF in Rel-17.
  + Further discuss also how GW-gNB interface should be specified (and if specified).

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | Yes |  |  |
| Ericsson | As commented during the draft review, those options are very unclear: would you mean RF requirements??? | | |
| Huawei | It depends on whether we just normalize the service link requirements from RF perspective or both service link and interface between repeater and gNB should be normalized. | | |
| CATT | Whatever the conclusion for Issue 2-1 and 2-2, the requirement will be put on NTN and part of the ground entity as a whole. Whether it is BS requirement or Repeater/Relay requirement needs further discussion. | | |
| Eutelsat | Yes |  |  |
| Nokia | Yes – in some deployments |  | Yes – in some deployments |
| Hughes/EchoStar | Unsure | Yes |  |
| ZTE | We need to discuss how to connect the Gateway and gNB firstly, then come back to this option s | | |
| Intelsat |  |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

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| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Ericsson | Disagree | BS requirements are for Base Station as defined in RAN4. I guess then moderator means RF requirements. But then, that depends on issue 2-1, this is redundant. |
| Huawei | Disagree | We can’t agree to discuss and consider the GW-gNB interface. |
| CATT |  | Propose to discuss 2-1 and 2-2 at first. |
| Eutelsat | Agree | Further discussions may be necessary to clarify architecture. |
| Nokia | Disagree | WF should be “Consider at least RF requirements for the satellite similar to those of a Rel-17 BS”. |
| Hughes/EchoStar | Partial | Consider at least BS requirements for satellite RF in Rel-17 |
| ZTE |  | We need to discuss how to connect the Gateway and gNB firstly, then come back to this options.  If cable connected between GW and gNB, then only BS requirement at satellite could be specified |
| Intelsat | Agree |  |
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After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-3 discussion.

**Issue 2-4: Possible relaxation of some satellite RF parameters**

* Proposals:
  + Option 1: Based on simulation and evaluation results for described NTN-TN coexistence scenarios in adjacent bands, work may further consider relaxing some of satellite RF requirements such as satellite ACLR and ACS, as compared with gNB RF requirements.
  + Option 2: Consider same gNB RF requirements for satellite RF.
* Recommended WF:
  + Further discussion for relaxing some of satellite RF requirements such as satellite ACLR and ACS, to be further considered in [98e][311] NTN\_Solutions\_Part2.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes  Please also see the justification in the comment from WF. | No |
| Ericsson | As already commented, relaxing is inappropriate as we have not set yet any requirement for NTN. But yes, based on coexistence simulations results, some requirements will be specified accordingly (it can go in both directions) | No, most likely BS and satellite RF requirements won’t have the same values. |
| Huawei | No, in current situation we can’t judge the “relaxing” | No, RF requirements should be discussed one by one |
| CATT | Requirement should be based on co-existence simulation results. It’s premature to say relax or reuse for the time being. | Requirement should be based on co-existence simulation results. It’s premature to say relax or reuse for the time being. |
| Qualcomm | No, the RF requirements should be based on co-ex study. | No, the RF requirements should be based on co-ex study. |
| Eutelsat | Yes (based on co-existence studies we would expect some relaxations to be possible). | No. |
| Nokia | No – There have been no study justifying relaxation | No – A starting point for the satellite based NTN gNB could be TN gNB but should be studied first |
| ZTE | It’s too early to make some prediction on the requirements. | It’s too early to make some prediction on the requirements. |
| Intelsat | Yes, Should be further evaluated | No |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree | The reference point for NTN-TN coexistence analysis should be on the ground, where the NTN signal and its out-of-band emission level will be significantly attenuated.    NTN SNR ISO curves in DL for Multiple Cells |
| Ericsson | Disagree | we need to develop appropriate ACLR and ACS based on co-existence studies |
| Huawei | Disagree | In current situation we can’t judge the “relaxing” |
| CATT | Disagree | Pending such discussion until the co-existence study is done. |
| Qualcomm | Disagree | It should depend on the co-ex study. Need further check after completing co-ex simulation results. |
| Eutelsat | Agree | Agree – clearly it will ultimately depend on the results of the RAN4 co-existence study. |
| Nokia | Partially disagree | We are fine to further discuss but can not accept a WF stating that the presumption is that the RF requirements should be relaxed. |
| Hughes/EchoStar | Agree |  |
| ZTE |  | It’s too early to make some prediction on the requirements and we need evaluation results to verify that. Such high level prediction is not quite useful. |
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Companies seem to agree that is too early to specify ACLR and ACS parameters for NTN. This should depend on the coexistence studies. RAN4 has to develop appropriate (NTN) ACLR and ACS based on co-existence studies.

After receiving feedback from companies, moderator suggests the following modification for the WF:

**Proposal 2-10:** RAN4 shall perform NTN coexistence studies that will identify NTN ACLR and ACS requirements to be used by satellite RF on the service link.

*Note:* These NTN requirements may be different (or not) from those used in TS 38.104 for TN.

**Proposal 2-11:** RAN4 shall develop appropriate NTN ACLR and ACS based on co-existence studies.

### Sub-topic 2-3 Reference Point Discussion

*Sub-topic description*

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

**Issue 2-5: Reference point of NTN requirements**

* Proposals:
  + Option 1: The reference point for NTN requirements and the test method need to be clarified.
  + Option 2: It should be noted that at least for FR1 where gateway can interface the gNB, conducted type of requirements can be used while for access part i.e. when satellite interfaces the UE, there is a need to develop proper OTA requirements..
    - UE reference point Conducted or OTA, between UE & satellite, at UE side.
    - BS reference point ARP or TAB, between GW & gNB, at gNB side.
  + Option 3: Only service link to be considered by RAN4 work in Rel-17. The corresponding UE and satellite RF requirements should be specified.
    - UE reference point Conducted or OTA, between UE & satellite, at UE side.
    - BS reference point as a Satellite Reference point Conducted or TAB or RIB, between UE & Satellite, at Satellite side.
* Recommended WF:
  + At least service link requirements should be discussed in Rel-17, with related reference points.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES |  |  | Yes |
| Ericsson | Yes | No, the description of this option doesn’t make sense. | No, again that depends on issue 2-1. |
| Huawei | Yes | No, what is the ARP? | Yes |
| CATT | Yes | Propose to focus on option 1 at first. | Proposed to focus 2-1 and 2-2 at first. |
| Qualcomm | Yes | No, should solve issue 2-1 first.  Clarification question: for UE, should RAN4 consider OTA test method for both handheld and VAST? | No, should solve issue 2-1 first.  Clarification question: for UE, should RAN4 consider OTA test method for both handheld and VAST? |
| Eutelsat |  |  | Yes |
| Nokia | Yes |  | Main bullet ok but sub-bullet is still for discussion |
| Hughes/EchoStar |  |  | Yes |
| ZTE | We need to discuss how to connect the Gateway and gNB firstly, then come back to this options.  Via wireless or via cable connected.  In addition, wireless connected for Uu interfance, then operation frequency should also clarified. | | |
| Intelsat |  |  | Yes |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Mediatek | Agree |  |
| Ericsson | Disagree | This depends on issue 2-1, “at least” is not acceptable. |
| Huawei | Partially agree | Remove “at least” |
| CATT | Disagree | This depends on issue 2-1 and 2-2. |
| Qualcomm | Agree |  |
| Eutelsat | Agree |  |
| Nokia | Partially Agree | Service link requirements should be discussed in Rel-17 but that does not preclude other requirements also to be discussed. |
| Hughes/EchoStar | Agree |  |
| Intelsat | Agree |  |
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Contributors are also encouraged to clarify what the “ARP” is.

After receiving feedback from companies, and after **removing “at least”**, moderator suggests the following WF:

**Proposal 2-12:** NTN service link requirements should be discussed in Rel-17 by RAN4, with related reference points.

*Note:* Service link requirements should be discussed in Rel-17 but that does not preclude other requirements also to be discussed.

### Sub-topic 2-4 Aspects to be Considered Out of Scope of 3GPP work in Rel-17

*Sub-topic description*

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

**Issue 2-6: Discussion for aspects out of scope of 3GPP RAN4 NTN Rel-17**

* Proposals:
  + Option 1: The following aspects should be considered out of scope of 3GPP since they are implementation dependent:
    - The fronthaul interface between the NTN-gateway and the gNB-DU. It is similar to the interface between gNB-DU and RRH. It may be a wire-line connection (e.g. Optical fibre, Ethernet cable, RF cable,..).
    - The NTN vehicle, which may be specific to each NTN infrastructure.
    - The NTN-Gateway, which is a transport node (RAN3 agreement).
    - The feeder link transporting the NR-Uu interface (RAN4 #97e agreement).
    - The NTN control function to control the NTN-vehicle(s) as well as the radio resources of the NTN payload(s).
* Recommended WF:
  + Decide what can be left for implementation only, and what should be discussed in Rel-17 for RAN4 NTN RF specification work.
  + If required, it can also be discussed how interfaces are specified (or if out of scope of 3GPP).

**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** |
| THALES | Partially agree | Agree with the following modifications:    The following aspects should be considered **out of scope** of 3GPP since they are implementation dependent:  - The fronthaul interface between the NTN-Gateway and the Non-RF gNB functions. It may be a wire-line connection (e.g. Optical fibre, Ethernet cable, RF cable,..).  - The NTN-Payload, which may be specific to each NTN infrastructure.  - The NTN-Gateway, which is a transport node (RAN3 agreement).  - The feeder link transporting the NR-Uu interface (RAN4 #97e agreement).  - The NTN control function to control the NTN-Payload and the NTN-Gateway. |
| Ericsson | Disagree | We don’t list what’s out of scope, but we define a scope. Moreover, some of the mentioned aspects are not RAN4 topics or are depending on issue 2-1 |
| Huawei | Partially agree | We don’t discuss the fronthaul interface between the NTN-Gateway and the Non-RF gNB functions in 3GPP. |
| CATT | Partially agree | Only focus on what is RAN4 scope rather than what is out of RAN4 scope. |
| Eutelsat | Agree with Thales |  |
| Nokia | Disagree | No need for this discussion or it should be conducted in relation to the WID at RAN. |
| ZTE |  | The fronthaul interface between the NTN-gateway and the gNB-DU. It is similar to the interface between gNB-DU and RRH. It may be a wire-line connection (e.g. Optical fibre, Ethernet cable, RF cable,..).  This should be very important issues needed to be clarified, otherwise lots of issues are cross-linked together. |
| Intelsat | Agree with Thales |  |
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After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-6 discussion.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Please see above |

### 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** |
| **Issue 2-1:** Satellite-FeederLink-Gateway Component | Proposed WF with respect to sources:   * 7 companies agrees * 1 company seems to disagree (NA)   Please also note that each satellite may connect to multiple gateways, and that each gateway can connect with multiple satellites.  *Tentative agreements:*  **Proposal 2-1:** RAN4 shall continue discussion on whether or not NTN-GW and gNB are wire-line connected (e.g. through Optical fibre, Ethernet cable, RF cable,..).  **Proposal 2-2:** RAN4 shall continue discussion on the NTN architecture to be used.  *Note:* the figure below may be used as example and modified accordingly    *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 2-2:**  Satellite-FeederLink-Gateway Component Type | Proposed WF with respect to sources:   * 5 companies agree * 2 company partially agree * 2 companies disagree with comments   It is further required to fully understand the impact of introducing a Relay-like or Repeater-like architecture in NTN in Rel-17.  *Tentative agreements:*  **Proposal 2-6:** RAN4 shall continue discussion to investigate if (NTN Payload-FeederLink-NTN Gateway) as a Relay is contradictory with transparent satellite assumption in Rel-17.  **Proposal 2-7:** RAN4 shall normalize the service link requirements from RF perspective. The corresponding UE and satellite RF requirements shall be specified.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 2-3:**  BS requirements for NTN (as for Rel-17) | After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-3 discussion.  *Tentative agreements:-*  *Candidate options:-*  *Recommendations for 2nd round:* After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-3 discussion. |
| **Issue 2-4:** Possible relaxation of some satellite RF parameters | Companies seem to agree that is too early to specify ACLR and ACS parameters for NTN. This should depend on the coexistence studies. RAN4 has to develop appropriate (NTN) ACLR and ACS based on co-existence studies.  *Tentative agreements:*  **Proposal 2-10:** RAN4 shall perform NTN coexistence studies that will identify NTN ACLR and ACS requirements to be used by satellite RF on the service link.  *Note:* These NTN requirements may be different (or not) from those used in TS 38.104 for TN.  **Proposal 2-11:** RAN4 shall develop appropriate NTN ACLR and ACS based on co-existence studies.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 2-5:** Reference point of NTN requirements | Contributors are also encouraged to clarify what the “ARP” is.  After receiving feedback from companies, and after **removing “at least”**, moderator suggests the following WF:  *Tentative agreements:*  **Proposal 2-12:** NTN service link requirements should be discussed in Rel-17 by RAN4, with related reference points.  *Note:* Service link requirements should be discussed in Rel-17 but that does not preclude other requirements also to be discussed.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 2-6:** Discussion for aspects out of scope of 3GPP RAN4 NTN Rel-17 | After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-6 discussion.  *Tentative agreements:-*  *Candidate options:-*  *Recommendations for 2nd round:* After receiving feedback from companies, moderator suggests to discuss 2-1 and 2-2 before continuing 2-6 discussion. |
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*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

-------------------------GTW Note on Feb.1st-------------------------------

Discussion:

Thales: In RAN3, we specify architecture with Non NTN gNB function and Non RF gNB function.

E///: This architecture is the assumption from RAN3 architecture. We prefer to have gNB as separate block.

ZTE: The connection between gateway and gNB can be uu interface.

RAN4 should define requirements for service link between satellite and UE; for the linkage between NTN gateway and gNB, pending on the connection assumption.

Eutelsat: We should specify RF requirements on the service link and left other to implementation.

Huawei: Share similar view with ZTE, there is no need to normalize the linkage between NTN-gateway and gNB. We should focus on service link from RF requirements aspect.

Thales: we have proposal 2-7 which aligned with companies proposed.

E///: we will have conformance test cases, without interface and reference points, it’s hard to define proper requirements.

CATT: How many nodes including in the block? Does exclude relay or repeater requirements.

Agreements:

RAN4 shall define the corresponding RF requirements for service link between UE and satellite

-From service link RF requirements aspect, candidate options for the components:

Option 1: Satellite + feedback + NTN-Gateway as a single entity

Option 2: Satellite + feedback + NTN-Gateway + gNB as a single entity

FFS whether RAN4 shall define RF requirements for the linkage between NTN-gate way and gNB

* Companies are encouraged to further clarify and discuss the assumption of the linkage between NTN-gate way and gNB

### 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 | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **TDoc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Proposed FR1 Exemplary Frequency band for NTN

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2100905](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100905.zip) | Samsung | **Proposal 1:** Prefer only 1 exemplary band for FR1 to minimize the work load of RAN4, and prefer S-band (1980-2010/2170-2200MHz) as the exemplary band. |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | CATT | **Proposal 1:** It is proposed to consider 1980-2010/2170-2200MHz for GEO satellite. |
| [R4-2101858](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101858.zip) | THALES | **Proposal 1:** Band characteristics (e.g. available BW, UL/DL configuration, maximum configurable BW size, coexistence conditions) of the candidate bands should be considered for comparison purposes. Note that views from operators should be taken into account in priority.   |  |  |  | | --- | --- | --- | | Parameter | Band “i” | Band “i+1” | | UL frequency band | - | - | | DL frequency band | - | - | | Maximum configurable BW size | - | - | | BW Configuration | - | - | | Coexistence conditions | - | - | | ITU Region Availability | - | - | | Others, e.g. view from operator | - | - | | - | - | - |   **Proposal 2:** RAN4 should consider at least MSS S-band as exemplary FR1 band for RAN4 coexistence scenarios. |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Huawei, HiSilicon | **Observation 1:** In order to reduce the regulatory risk, RAN4 can start the work with a frequency band in which MSS is used without incumbent service.   |  |  |  | | --- | --- | --- | | **Frequency bands** | **Pros** | **Cons** | | L-band | 1. It’s a traditional MSS band for satellite. The industry chain can be reused.  2. The lower path loss can be achieved.  3. There is no regulatory risks  4. In RAN4, all of the commercial FDD frequency bands are below 3GHz. | 1. There is an in-device co-existence issue between GNSS and NTN.  2. The available channel bandwidth is not enough. | | S-band | 1. It’s a traditional MSS band for satellite. The industry chain can be reused.  2. The lower path loss can be achieved.  3. In RAN4, all of the commercial FDD frequency bands are below 3GHz. | 1. The frequency range overlapped with band n65  2. The available channel bandwidth is not enough. | |  |  |  |   **Proposal 1:** It’s proposed to choose L band as exemplary band for NTN topic. |
| [R4-2102173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102173.zip) | Ericsson | **Proposal 4:** NTN bands shall be either fully in FR1 or fully in FR2, but not only partly in FR1 or FR2.  **Proposal 5:** Use the proposed chunk of L-band for the first FR1 NTN band. |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | CMCC | **Observation 1:** Once NTN band is the same as or overlapping with IMT operating band, it is possible that the satellite and IMT operate in co-channel rather than adjacent-channel as how different mobile operators have done to avoid interference. This co-channel operation would result in destructive interference and make it hard for the actual application.  **Proposal 1:** It should be emphasized that the frequency ranges considered for satellite should be spectrum allocated by ITU to satellite services on a primary basis rather than secondary basis.  **Proposal 2:** at current stage L band would be more appropriate as exemplary band for NTN considering S band may introduce harmful interference for current deployed IMT network. |
|  |  |  |

## 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 Criteria to be considered for FR1 exemplary frequency band selection

*Sub-topic description:*

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

**Issue 3-1: Criteria to be considered for FR1 exemplary frequency band selection**

* Proposals:
  + Option 1: Band characteristics (e.g. available BW, UL/DL configuration, maximum configurable BW size, coexistence conditions) of the candidate bands should be considered for comparison purposes. Note that views from operators should be taken into account in priority.

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Band “i”** | **Band “i+1”** |
| UL frequency band | - | - |
| DL frequency band | - | - |
| Maximum configurable BW size | - | - |
| BW Configuration | - | - |
| Coexistence conditions | - | - |
| ITU Region Availability | - | - |
| Others, e.g. view from operator | - | - |
| - | - | - |

* + Option 2:

|  |  |  |
| --- | --- | --- |
| **Frequency bands** | **Pros** | **Cons** |
| L-band | 1. It’s a traditional MSS band for satellite. The industry chain can be reused.  2. The lower path loss can be achieved.  3. There is no regulatory risks  4. In RAN4, all of the commercial FDD frequency bands are below 3GHz. | 1. There is an in-device co-existence issue between GNSS and NTN.  2. The available channel bandwidth is not enough. |
| S-band | 1. It’s a traditional MSS band for satellite. The industry chain can be reused.  2. The lower path loss can be achieved.  3. In RAN4, all of the commercial FDD frequency bands are below 3GHz. | 1. The frequency range overlapped with band n65  2. The available channel bandwidth is not enough. |
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* Recommended WF:
  + Integrate all values/opinions in Option 1, and then decide.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes |  |
| Mediatek | Yes |  |
| Ericsson | Max configurable BW and BW configuration are not relevant criteria, we can add any channel BW on motivated request. But band size is relevant. | No, we disagree with some statements in this analysis. |
| Huawei | It’s related to the system parameters. However, we can’t use these system parameter to judge which FR1 band should be selected. | Yes |
| CATT | It seems option 1and 2 are not in parallel. | It seems option 1and 2 are not in parallel. |
| Qualcomm | Yes | A bit confusing. What’s does this option 2 mean? To agree the statements in the table? |
| Eutelsat | Yes |  |
| Hughes/EchoStar | Yes | S Band overlap with band n65 is not a “con” as stated above. Instead this was intentionally done to position S band for its CGC deployment. Being next to Band 1 made sense to combine into band 65, which is a “Pro” – i.e., leverage common device |
| ZTE | Option 1 and Option 2 is complementary instead of contradicting with each other. | |
| Intelsat | Yes (Consideration should be given to both L and S band) |  |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Mediatek | Agree |  |
| Ericsson | Disagree | We are ok to first build a list of criteria to make the analysis, and then we could further each of the criteria. |
| Huawei | Disagree | Argument in option 2 should be considered. |
| Qualcomm | Agree |  |
| Eutelsat | Agree |  |
| Hughes/EchoStar | Agree |  |
| Intelsat | Agree |  |
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After receiving feedback from companies, moderator suggests the following modification for the WF:

**Proposal 3-1:** RAN4 shall build a list of criteria to make the analysis and decide what exemplary band shall be used for FR1: MSS S-Band or MSS L-Band.

*Note:* This is exactly what the moderator proposed at the first place. It would be very useful to have this set of criteria for the 2nd round so we can decide in RAN4#98e what exemplary band to use for FR1 in the coexistence studies.

### Sub-topic 3-2 MSS S-Band or L-band decision

*Sub-topic description*

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

**Issue 3-2: MSS S-Band or L-band for FR1**

* Proposals:
  + Option 1: MSS S-band as exemplary band for NTN topic in FR1

|  |  |
| --- | --- |
| **Parameter** | **MSS S-Band** |
| UL frequency band | 1980-2010 MHz |
| DL frequency band | 2170-2200 MHz |
| Maximum configurable BW size | 20 MHz |
| BW Configuration | 5, 10, 15, 20 MHz |
| Coexistence conditions | Adjacent-band coexistence in all regions. Avoid usage of this range in North America. |
| ITU Region Availability | R1, R3, R2 (but avoid North America) |
| Others, e.g. view from operator | Clear regulatory requirement, link budget analysis already done in TR 38.821, some coexistence studies already done in TR 38.891 (including coexistence with adjacent bands), MSS S-band is already used for satellite services (and is operational). |

* + Option 2: MSS L-band as exemplary band for NTN topic in FR1
  + Option 3: Both MSS S-band and MSS L-band as exemplary bands for NTN topic in FR1
  + *Note*: many companies already argued that it should be **only one** considered for the time being, or at least **one with priority**.
* Recommended WF
  + TBA

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | Yes | No | No |
| Samsung | Yes |  |  |
| Mediatek | Yes |  |  |
| Ericsson | No, first we donät agree with some of the given arguments and then we don’t think this is the best option | Yes | No |
| Huawei | It’s overlapping with band n65. Co-channel coexistence evaluation in ITU is needed. Otherwise, we may face uncertain regular risks. Cross link interference can’t be ignored. | Yes | No |
| CATT | Yes as indicated in our paper. |  |  |
| CMCC |  | More preferred |  |
| Qualcomm | Yes |  |  |
| Hughes/EchoStar | Yes |  |  |
| ZTE | It’s overlapping with legacy IMT bands, then co-channel coexistence might happen? |  |  |
| Intelsat |  |  | Yes |
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A few comments from the moderator:

* Co-channel coexistence is not the scope of RAN4, only adjacent channel coexistence (already discussed and agreed in RAN4#97e for NTN).
* Moreover, it is clearly stated in the proposals which region shall/should be avoided for coexistence studies.
* Companies to check if the “cross-link interference” can be included in the “coexistence conditions”.

After receiving feedback from companies, moderator suggests the following modification for the WF:

**I3f):** RAN4 shall provide inputs for the following comparison table (add other criteria if required):

|  |  |  |
| --- | --- | --- |
| **Parameter** | **MSS S-Band** | **MSS L-Band** |
| UL frequency band | THALES: 1980-2010 MHz  COMPANY Y: | COMPANY X:  COMPANY Y: |
| DL frequency band | THALES: 2170-2200 MHz  COMPANY Y: | COMPANY X:  COMPANY Y: |
| Maximum configurable BW size | THALES: 20 MHz  COMPANY Y: | COMPANY X:  COMPANY Y: |
| BW Configuration | THALES: 5, 10, 15, 20 MHz  COMPANY Y: | COMPANY X:  COMPANY Y: |
| Coexistence conditions | THALES: Adjacent-band coexistence in all regions. Avoid usage of this range in North America.  COMPANY Y: | COMPANY X:  COMPANY Y: |
| ITU Region Availability | THALES: R1, R3, R2 (but avoid North America)  COMPANY Y: | COMPANY X:  COMPANY Y: |
| Others, e.g. view from operator | THALES: Clear regulatory requirement, link budget analysis already done in TR 38.821, some coexistence studies already done in TR 38.891 (including coexistence with adjacent bands), MSS S-band is already used for satellite services (and is operational).  COMPANY Y: | COMPANY X:  COMPANY Y: |
| In-device coexistence with GNSS | COMPANY X:  COMPANY Y: | COMPANY X:  COMPANY Y: |
| Cross-link interference? | COMPANY X:  COMPANY Y: | COMPANY X:  COMPANY Y: |
| Other criteria? | COMPANY X:  COMPANY Y: | COMPANY X:  COMPANY Y: |
| … |  |  |

Ericsson suggested making a new list and therefore this initial list will not be considered in totality. **Proposal I3f) will not be considered for the 1st round.**

### Sub-topic 3-3 Selection of FR1 Exemplary Band based on GNSS in-device coexistence issue

*Sub-topic description:*

*Current NTN UE UL synchronization solution in Rel-17 is a GNSS-based solution (see RAN1, UE with GNSS capability in Rel-17). The GNSS on UE is used at least for initial (time and frequency) synchronization of UE with the NTN system.*

*The scope of this discussion is to see if in-device coexistence issue between NTN UE GNSS Rx and NTN UE transceiver may result in (unwanted) UL synchronization issues if e.g. UE is not capable to correctly use its GNSS in order to connect with the NTN system.*

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

**Issue 3-3: Selection of FR1 Exemplary Band based on GNSS in-device coexistence issue**

* Proposals:
  + Option 1: FR1exemplary band **selection criteria should consider** potential GNSS in-device coexistence issue.
  + Option 2: FR1exemplary band **selection criteria should not consider** potential GNSS in-device coexistence issue.
* Recommended WF:
  + Priority in Rel-17 should be given for exemplary band that has no potential GNSS in-device coexistence issue
  + *Note:* the time and frequency synchronisation method for NTN UE in Rel-17 is based on GNSS capability.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

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| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes |  |
| MediaTek | Yes, due to the use of GNSS capability for synchronization, we prefer NTN exemplary bands without potential UE impact related to in-device co-existence with GNSS. |  |
| Ericsson | Yes, this could be one criteria, but not the only one |  |
| Huawei | It can leave UE implementation to solve it. | Yes |
| CATT | We think GNSS in-device coexistence issue is not a key factor to decide the example band. | |
| Qualcomm | Yes, GNSS is one of key points for NTN |  |
| Eutelsat | Yes |  |
| Hughes/EchoStar | Yes, this is a complex matter and can delay the work |  |
| ZTE | For in-device issues, it should be left up to implementation. |  |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

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| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree | The time and frequency synchronisation method for NTN UE in Rel-17 is based on UE with GNSS capability.  If there might be any issue with UE GNSS capability assumption, then the respective MSS FR1 band should not be considered (at least in a first step for the 1st exemplary FR1 band selection). |
| Mediatek | Agree | We prefer NTN exemplary bands without potential UE impact related to in-device co-existence with GNSS |
| Ericsson | Disagree | Again, as proposed in 3.2.1, first work on building the list of criteria before discussing any of them, let’s do a correct analysis without biaising the result. |
| Huawei | Disagree | It can leave UE implementation to solve it. |
| CATT | Disagree | It is not a key factor for selecting example band. The purpose of example band is to develop Band specific requirement |
| Qualcomm | Agree |  |
| Eutelsat | Agree |  |
| Hughes/EchoStar | Agree | Potential issue with GNSS/GPS is a complex matter and should be avoided so as to not delay the work in Rel-17 |
| ZTE | Disagree | For in-device issues, it should be left up to implementation. |
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Proposed WF with respect to sources:

* 5 companies agree
* 4 companies disagree

Even if left for implementation issue, UE GNSS capability may be affected when in-device coexistence issue. Unfortunately, at least as for Rel-17, NTN UE time and frequency synchronization is highly dependent on UE GNSS capability and RAN4 may have to perform additional studies for NTN operation in L-band. The criterion has been therefore included in Proposal 3-2.

Companies are highly encouraged to submit their views in Proposal 3-2.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Please see above |

### 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.*

|  |  |
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|  | **Status summary** |
| **Issue 3-1:** Criteria to be considered for FR1 exemplary frequency band selection | After receiving feedback from companies, moderator suggests the following modification for the WF:  *Tentative agreements:*  **Proposal 3-1:** RAN4 shall build a list of criteria to make the analysis and decide what exemplary band shall be used for FR1: MSS S-Band or MSS L-Band.  *Note:* This is exactly what the moderator proposed at the first place. It would be very useful to have this set of criteria for the 2nd round so we can decide in RAN4#98e what exemplary band to use for FR1 in the coexistence studies.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 3-2:**  MSS S-Band or L-band for FR1 | A few comments from the moderator:   * Co-channel coexistence is not the scope of RAN4, only adjacent channel coexistence (already discussed and agreed in RAN4#97e for NTN). * Moreover, it is clearly stated in the proposals which region shall/should be avoided for coexistence studies. * Companies to check if the “cross-link interference” can be included in the “coexistence conditions”.   After receiving feedback from companies, moderator suggested a new proposal **I3f)** including more parameters, but this has not been accepted.  *Tentative agreements:*   * **Fallback to Proposal 3-1**   *Candidate options:-*  *-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 3-3:**  Selection of FR1 Exemplary Band based on GNSS in-device coexistence issue | Proposed WF with respect to sources:   * 5 companies agree * 4 companies disagree   Even if left for implementation issue, UE GNSS capability may be affected when in-device coexistence issue.  Unfortunately, at least as for Rel-17, NTN UE time and frequency synchronization is highly dependent on UE GNSS capability and RAN4 may have to perform additional studies for NTN operation in L-band. The criterion has been therefore included in Proposal 3-2.  Companies are highly encouraged to submit their views in Proposal 3-2.  *Tentative agreements:*  **Proposal 3-4: Agree to include GNSS in-device coexistence in the list of criteria from Proposal 3-1.**  *Candidate options:-*  *Recommendations for 2nd round:* Companies are highly encouraged to submit their views in Proposal 3-2. |
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----------------------GTW Note on Feb.1 --------------------------

Candidate bands for FR1:

L-band (E///, Huawei, CMCC)

S-band (Hughes, THALES, Samsung, Qualcomm, MTK, Nokia, Eutesat)

Huawei: S-band can’t be deployed as TN and NTN simultaneously in same regions, to share the same channel.

THALES: Are you referring the co-existence with band n65? The initial sync based on GNSS, for in-device co-existence study need to be carried out for L-band.

E///: There is no satellite deployed in the same region for band n65.

Hughes: band n65 is overlapped with S-band, the frequency range deployment in EU for both TN and NTN for some specific usage case.

QC: We should respect the demand from operators.

Samsung: We are open to include both bands, if operators have interest on that.

Verizon ：We respect the majority view and S-band should be fine.

Nokia: We should have the common understanding pending Rel-17 output we can further check the status for each and conclude whether this band can be included into specification under the condition the corresponding work already done.

Agreements:

Include S-band, L-band as exemplary bands for FR1

* Using S-band frequency range i.e. 2GHz for co-existence simulation in FR1

At least one of above bands RF requirements completed, then Rel-17 NTN WI, RF requirements for FR1 can be considered as completed.

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

### 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 | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **TDoc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: Proposed Exemplary Frequency band outside FR1 (e.g. FR2 and/or outside FR1&FR2) for NTN NR based satellite networks

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2102173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102173.zip) | Ericsson | **Proposal 4:** NTN bands shall be either fully in FR1 or fully in FR2, but not only partly in FR1 or FR2. |
| [R4-2102374](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102374.zip) | HUGHES Network Systems, Thales, Inmarsat, Intelsat, Fraunhofer, ESA | **Proposal 1:** Frequency bands allocated to satellite services above 10 GHz can be treated as FR2 band for consideration by RAN4 specification work.  **Proposal 2:** “3GPP TR 38.820: NR; 7-24 GHz frequency range” can also be used as reference.  **Proposal 3:** New band definitions for NTN operating in frequencies in FR2 or FR2-like (7-24 GHz range) shall assume NTN operating in FDD mode. |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | CATT | **Proposal 2:** It is proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite. |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | CMCC | **Observation 2:** it is up to RAN plenary to decide whether to study the NTN bands falling into 7-24GHz.  **Proposal 3:** it is appropriate not identifying any FR2 exemplary bands at current stage because it is hard to seek an exemplary band completely for FR2. |
| [R4-2100905](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100905.zip) | Samsung | **Proposal 2:** Deprioritize FR2 exemplary band at this stage. |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Huawei, HiSilicon | |  |  |  | | --- | --- | --- | | **Frequency bands** | **Pros** | **Cons** | | Ka-band | This frequency band can provide large available channel bandwidth. | 1. Based on the NR NTN WID, RAN4 can only consider the NTN operating bands in FR1 or FR2 ranges. The Ka-band is neither FR1 nor FR2, so it’s out of the WID’s scope.  2. The frequency span between UL and DL is about 13GHz. Considering the relative channel bandwidth, it’s very difficult to use the same Antenna for both Tx and Rx. The solution of separate antennas will increase the satellite’s weight and cost.  3. Currently, only GEO can be used for this band. The larger output power is needed for both satellite and UE transmitter. In addition, we need to improve the isolation between Tx and Rx link in high frequency range, so it’s very challenge to implement such RF chain. Larger propagation delay should be considered.  4. The UL frequency range overlapped with n257 and n261. The two systems cannot be synchronized. The cross link interference need to be checked.  5. There are a lot of co-existence issues and regulatory risks since Ka-band is used for FSS. | |
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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 Consideration of Bands for NTN which Partly Falls in FR2

*Sub-topic description:*

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

**Issue 4-1: Partly FR2 NTN bands**

* Proposals:
  + Option 1: No.
    - NTN bands shall be either fully in FR1 or fully in FR2, but not only partly in FR1 or FR2.
  + Option 2: Yes.
    - It is proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite.
* Recommended WF
  + TBA

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes |
| Ericsson | Agree | No, this can’t be done in this WI as it’s only partly in FR2. This is not realistic |
| Huawei | Agree | No, this option is out of the WI’s scope. |
| CATT | We are not sure the option is clear enough. It’s not appropriate to limit the NTN bands fully falling current FR1 or FR2 since FRs depends on the demands and can be extended. | The main issue is work load. Depends on Issue 1-3 discussion. |
| CMCC | Agree |  |
| Qualcomm |  | Yes |
| Hughes/EchoStar |  | Yes |
| ZTE | Yes, to maximize the existing commericial design and requirement definition, otherwise it’s impossible to finish all the related requirements. |  |
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Opinions are mitigated between companies. It has been proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite (partly FR2) and:

* 3 companies indicated a clear agree;
* 3 companies indicated a clear disagree;
* 2 companies indicated potential work overload in RAN4.

Moderator suggests continuing discussion for the (potential) WF(s).

### Sub-topic 4-2 Consideration of Bands for NTN above FR1

*Sub-topic description:*

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

**Issue 4-2:** New bands definition for NTN operating in frequencies above FR1.

* Proposals:
  + Option 1: Frequency bands allocated to satellite services **above FR1** (greater than 7 GHz: FR2 or 7-24 GHz range) **can be treated as FR2 bands** for consideration by RAN4 specification work.
  + Option 2: Frequency bands allocated to satellite services **above FR1** (greater than 7 GHz: FR2 or 7-24 GHz range) **can use the study** “3GPP TR 38.820: NR; 7-24 GHz frequency range” for consideration by RAN4 specification work.
  + Option 3: RAN plenary to decide.
* Recommended WF:
* Further discuss the possibility of considering NTN operating in frequencies above FR1 (greater than 7 GHz: FR2 or 7-24 GHz range).
* Consider at least “3GPP TR 38.820: NR; 7-24 GHz frequency range” as useful reference.
* *Note:* Please note that all satellite bands are FDD

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | Yes | Yes |  |
| Ericsson | No, this is not correct many aspects might differ: requirements, SCS, technology capabilities, deployment scenarios, … | No, 7-24 shall be first specified in RAN4 TS before working on such NTN band. The TR is not sufficient | This seems an useless option as RAN plenary tasked RAN4 to decide.. Proponents need to provide technology analysis and technical justification in RAN4 that motivates why the frequencies have the same behaviour and requirements as FR2. RAN plenary is not the place to analyse whether applying FR2 SCS, behaviour and requirements to these frequencies is technologically feasible, hence the reason for the RAN4 WI |
| Huawei | No, it has an impact on other working group if we plan to create a new frequency range. | No, TR 38.820 just focus on TN instead of NTN. We can’t simply use this TR for NTN. | No, technique issues should be addressed in working group. |
| CATT | It’s hard to answer these questions before working on such bands in detail. | |  |
| Qualcomm | Yes | No, it depends on the frequency range |  |
| Hughes/EchoStar | Yes | Yes |  |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Ericsson | Disagree | 7-24GHz is not part of NTN WI, that would require too much effort. Technically it is not proven to be the same. Technology characteristics differ, procedures etc. may differ from FR2 |
| Huawei | Disagree | TR 38.820 just focus on TN instead of NTN. We can’t simply use and discuss this TR for NTN. |
| Qualcomm | Agree | TR38820 can be used as the reference. |
| Hughes/EchoStar | Agree |  |
| ZTE | Disagree | Currently, there are no RF requirements defined for 7-24GHz SID yet, if define NTN band, then how to coexist between NTN and TN. |
| Intelsat | Agree |  |
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Proposed WF with respect to sources:

* 4 companies agree;
* 3 company disagree for different reasons.

It has been suggested that if may require too much effort to introduce a frequency range different from FR2. Moderator suggests the following modifications for WF(s):

**Proposal 4-1:** Further continue discussing the possibility of considering NTN operating in frequencies above FR1 (greater than 7 GHz: FR2 or 7-24 GHz range) for **the coexistence studies in RAN4.**

**Proposal 4-2:** Further continue discussing the possibility of considering NTN operating in FR2 for **the coexistence studies in RAN4.**

**Proposal 4-3:** Further continue discussing the possibility of considering NTN operating in 7-24 GHz range for **the coexistence studies in RAN4.**

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Please see above |

### 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** |
| **Issue 4-1:**  Consideration of Bands for NTN which Partly Falls in FR2 | Opinions are mitigated between companies. It has been proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite (partly FR2) and:   * 3 companies indicated a clear agree; * 3 companies indicated a clear disagree; * 2 companies indicated potential work overload in RAN4.   *Tentative agreements:-*  *Candidate options:-*  *Recommendations for 2nd round:* Moderator suggests continuing discussion for the (potential) WF(s). |
| **Issue 4-2:** Consideration of Bands for NTN above FR1 | Proposed WF with respect to sources:   * 4 companies agree; * 3 company disagree for different reasons.   It has been suggested that if may require too much effort to introduce a frequency range different from FR2. Moderator suggests the following modifications for WF(s):  *Tentative agreements:*  **Proposal 4-1:** Further continue discussing the possibility of considering NTN operating in frequencies above FR1 (greater than 7 GHz: FR2 or 7-24 GHz range) for **the coexistence studies in RAN4.**  **Proposal 4-2:** Further continue discussing the possibility of considering NTN operating in FR2 for **the coexistence studies in RAN4.**  **Proposal 4-3:** Further continue discussing the possibility of considering NTN operating in 7-24 GHz range for **the coexistence studies in RAN4.**  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
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*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

--------------------------------GTW note on Feb.1------------------------

ZTE: What’s the assumption for DL co-existence with 20GHz?

E///: Similar view as ZTE, we should consider in later phase.

Huawei: Ka band is out of scope in the WID, RAN4 only can consider the operating FR1 or FR2 frequency range. We should consider it in later phase considering the work load of this WI.

Nokia: Similar comments as E////Huawei; we didn’t clear candidate band within FR2. We can consider in later phase.

THALES：We think FR2 co-existence study is quite important with different deployment scenarios. This would be NTN (FDD) and TN (TDD).

Hughes：We agree FR1 can be major focus, meanwhile we should not exclude FR2 use cases.

Eutelsat: There are lots of assumptions need to be resolved. We should focus on FR1 only for co-existence.

Agreements:

* It’s FFS whether Ka bands can be introduced in the Rel-17 NTN WD as exemplary band with FR2 usage assumption pending on RAN-P decision.
* ~~Before RAN-plenary have clear guidance for Ka band treatment, no detailed discussion for RF requirements for Ka bands except the co-existence study~~
* ~~Considering 20GHz (DL) and 30GHz (UL) as frequency for FR2 NTN co-existence study purpose as 2~~~~nd~~ ~~priority before RAN-P have clear guidance~~

### 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 | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **TDoc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #5: HAPS Discussion

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Huawei, HiSilicon | **Observation 2:** RAN4 can further discuss the exemplary bands for HAPS based on the operators’ input. |
| [R4-2101933](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101933.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** ITU separates spectrum for satellite and HAPS deployments in separate groups.  **Observation 2:** Reuse of terrestrial spectrum and already defined 3GPP bands for HAPS deployments will facilitate a rapid deployment of IMT systems into rural areas.  **Observation 3:** HAPS are already deployed in the LTE spectrum it should be natural also to support these deployments in NR spectrum.  **Proposal 1:** There is no need to specify any new HAPS specific bands in NTN WI but select at least one example band from the existing NR bands identified for HAPS deployment.  **Proposal 2:** To demonstrate coexistence between HAPS and TN networks, RAN4 to study at least one example band in FR1 and focus on adjacent channel issues.  **Proposal 4:** RF requirements for a terrestrial gNB should be used as baseline for HAPS, LEO and GEO deployments. |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | CATT | **Proposal 3:** It is proposed to consider 2GHz for HAPS as the example frequency for co-existence study. |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | CMCC | **Observation 3:** The definition of HIBS is under discussion in WP5D. 3GPP could send LS to ITU for more clarifications, if needed.  **Observation 4:** HIBS could only use the spectrum allocated for IMT application while HAPS could also use spectrum allocated for fixed service.  **Observation 5:** Existing UE served by ground-based IMT base stations would also be served by HIBS to provide connection where used to be unserved such as in rural and remote areas.  **Proposal 4:** it is suggested to replace the terminology “HAPS” by “HIBS” because the stations deployed in HPAS is not limited to IMT BS. Once the stations are not IMT compatible, new interface, physical channel and signal process procedure are all required to be updated.  **Proposal 5:** It is suggested to focus on NTN study. if time is allowed HIBS could be included in NTN scope. |
|  |  |  |

## 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 HAPS Exemplary Frequency Band

*Sub-topic description:*

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

**Issue 5-1: HAPS Exemplary Frequency Band**

* Proposals
  + Option 1: There is no need to specify any new HAPS specific bands in NTN WI but select at least one example band from the existing NR bands identified for HAPS deployment.
  + Option 2: It is proposed to consider 2GHz for HAPS as the example frequency for co-existence study.
* Recommended WF
  + RAN4 to study at least one example band in FR1 for HAPS, from the existing NR bands identified for HAPS deployment.
  + RAN4 can further discuss the exemplary band for HAPS based on the operators’ input.

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes | Yes |
| Ericsson | No, we can’t select any NR band, it shall be a band allocated by ITU-R for HAPS/HIBS.  The definition of HIBS is under discussion in WP5D. 3GPP should send LS to ITU for more clarifications, if needed. | Ok |
| Huawei | Share the same view with Ericsson | Yes |
| CATT |  | Yes |
| CMCC | As discussed in our contribution the definition of HIBS is under discussion in WP5D. From our point of view, it should be the bands allocation for HIBS not HAPS. 3GPP could send LS to ITU for more clarifications, if needed. | Further clarification of the detailed range of 2GHz? |
| Qualcomm |  | Yes |
| SoftBank | We believe that HAPS can use the existing NR bands based on our experiences, and recognize that this proposal is to choose example band(s) for conducting technical study rather than identifying HAPS bands.  It might be better to discuss whether to consider HAPS under this WI in RAN4 in the first place. | There is another discussion about the example frequency for co-ex study in issue 5-2 in NTN[98e][311].  It would be preferable to discuss this together. |
| Nokia | Yes | Yes |
| Hughes/EchoStar | Yes |  |
| ZTE | The same view as Ericsson | Yes |
| Intelsat | Yes |  |
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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.**

[Note3 (general): Please provide feedback also for the proposed WF(s)]

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| Ericsson | Partially agree | We agree that any band to be specified by RAN4 for HAPS as IMT BS should be a mobile operator band, hence we should most likely better use the nomenclature HIBS  While operators input is key for the definition of a HAPS as IMT BS (HIBS) band, the provisions in the RR are to be taken into account. |
| CATT | Agree |  |
| CMCC |  | As discussed in our contribution the definition of HIBS is under discussion in WP5D. From our point of view, it should be the bands allocation for HIBS not HAPS. 3GPP could send LS to ITU for more clarifications, if needed. |
| Qualcomm | Agree |  |
| SoftBank |  | As mentioned above, we believe that HAPS can use the existing NR bands. So, the example band(s) should be used as an example for technical study, and should not be used to identify the bands available in HAPS. |
| Nokia | Agree | We can select an existing NR band from the frequency bands allocated for HAPS mobile services by ITU-R. |
| Hughes/EchoStar | Partial | RAN4 may use existing NR bands identified for HAPS deployment. |
| Intelsat | Agree |  |
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All companies seem to agree or partially agree. Moderator suggests the following WF:

**Proposal 5-1:** RAN4 to study one example band in FR1 for HAPS, from the existing NR bands identified for HAPS deployment.

*Note:* Example band should be used as an example for technical study.

### Sub-topic 5-2 HAPS RF Requirements

*Sub-topic description*

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

**Issue 5-2: HAPS RF Requirements**

* Proposals
  + Option 1: RF requirements for a terrestrial gNB should be used as baseline for HAPS
* Recommended WF
* Further discuss if RF requirements for a terrestrial gNB should be used as baseline for HAPS

**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** |
| THALES | Agree |  |
| Ericsson | disagree | Rather than assuming a baseline, we propose to run co-existence simulations as usual and conclude on the requirements |
| CATT | Partially agree | TN gNB requirement could be an important reference. We can compare HAPS and gNB in detail later. |
| Nokia | Disagree | Given that the operational scenario and propagation channel of HAPS are different from the terrestrial networks, we do not agree using terrestrial gNB requirements as baseline for HAPS. Instead, we think requirements for HAPS should be derived from co-existence simulation results with assumptions matched to realistic scenarios. |
| Intelsat | Agree |  |
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Based on the feedback, moderator suggests the following WF:

**Proposal 5-2:** RAN4 to study coexistence scenarios in order to derive RF requirements used as baseline for HAPS.

### Sub-topic 5-3 HAPS/HIBS Discussion

*Sub-topic description*

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

**Issue 5-3: HAPS terminology change to HIBS**

* Proposals
  + Option 1: Replace the terminology “HAPS” by “HIBS”
  + Option 2: Do not replace the terminology “HAPS” by “HIBS”
  + Option 3: Further continue discussion in RAN Plenary.
* Recommended WF
  + TBA

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES |  |  | Yes |
| Ericsson | Yes  As RAN agreed to define HAPS as IMT BS, should we better call it HIBS now? | No | No. The same discussion will happen in RAN4/RAN  No, this has already been clarified in last RAN plenary, it shall be HAPS as IMT BS operation. |
| Huawei | Yes | No | No |
| CATT | Yes. | No | No |
| SoftBank | No | Yes  This issue has already been addressed in the last RAN plenary and we agreed to use HAPS with the following texit in the latest WID (PR-202908):  *HAPS refers to a high altitude platform system for which at least the service link (HAPS – UE) operates a 3GPP specified NR mobile service in allocated spectrum which regulation allows*  Once agreed upon, it is not desirable to discuss it again. | No |
| Nokia | No, the HIPS definition is still ongoing within ITU | Yes, with the understanding that the HAPS requirements in RAN4 apply to IMT mobile services provided by HAPS. | No. We prefer to wait until ITU has a clear definition of HIBS to consider change of terminology. |
| Hughes/EchoStar |  |  | Yes |
| Intelsat |  | Yes |  |
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Not a clear conclusion for way forward. Moderator suggests waiting until ITU has a clear definition of HIBS to consider change of terminology. As also explained by SoftBank, this issue has already been addressed in the last RAN plenary and it was agreed to use HAPS, as in the latest updated WID (RP-202908): *“In the context of this work item, HAPS refers to a high altitude platform system for which at least the service link (HAPS – UE) operates a 3GPP specified NR mobile service in allocated spectrum which regulation allows. If needed, the terminology “HAPS” may be revisited.”*

**Issue 5-4: HIBS Discussion**

* Proposals
  + Option 1: Focus on NTN study.
  + Option 2: If time is allowed HIBS could be included in NTN scope.
* Recommended WF
  + TBA

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

[Note1 (general): Options are not exclusive. Companies may answer “Yes” or “No” to multiple options.]

[Note2: **Companies are encouraged to provide justification** for their choices.]

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes | Yes |
| Ericsson | Ok | Ok, or it could be handled in a separate WI? |
| Huawei | Yes | Maybe a separate WI is a good choice just like ATG, otherwise we include so many objectives in this WI, |
| CATT | OK | OK |
| Qualcomm | Clarifications questions: In Issue 5-3, it was discussing “HAPS terminology change to HIBS”. If we presume HAPS should change to HIBS. While here option 2 proposes to include HIBS in the NTN scope. Is it the correct understanding that companies still have different views on HAPS and HIBS? | |
| Nokia | Yes – This also includes HAPS as one of NTN’s deployment scenarios. | No – HIPS/HAPS should be covered in NTN co-existence scenarios. Workload can be balanced by limiting the total number of simulation cases. |
| Hughes/EchoStar | Yes |  |
| Intelsat | Yes | Partially agree : If additional time is needed. |
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All companies agree to focus on NTN study. Since “NTN” is already part of updated WID RP-202908, the moderator has no suggestion for the WF.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Please see above |

### 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** |
| **Issue 5-1:**  HAPS Exemplary Frequency Band | All companies seem to agree or partially agree.  Moderator suggests the following WF:  *Tentative agreements:*  **Proposal 5-1:** RAN4 to study one example band in FR1 for HAPS, from the existing NR bands identified for HAPS deployment.  *Note:* Example band should be used as an example for technical study.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 5-2:** HAPS RF Requirements | Based on the feedback, moderator suggests the following WF:  *Tentative agreements:*  **Proposal 5-2:** RAN4 to study coexistence scenarios in order to derive RF requirements used as baseline for HAPS.  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |
| **Issue 5-3:** HAPS terminology change to HIBS | Not a clear conclusion for way forward.  Moderator suggests waiting until ITU has a clear definition of HIBS to consider change of terminology. As also explained by SoftBank, this issue has already been addressed in the last RAN plenary and it was agreed to use HAPS, as in the latest updated WID (RP-202908): *“In the context of this work item, HAPS refers to a high altitude platform system for which at least the service link (HAPS – UE) operates a 3GPP specified NR mobile service in allocated spectrum which regulation allows. If needed, the terminology “HAPS” may be revisited.”*  *Tentative agreements:-*  *Candidate options:-*  *Recommendations for 2nd round:* Not a clear conclusion for way forward. |
| **Issue 5-4:** HIBS Discussion | All companies agree to “focus on NTN” study, where HAPS is part of NTN.  Since “NTN” is already part of updated WID RP-202908, the moderator has no suggestion for the WF.  *Tentative agreements:-*  *Candidate options:-*  *Recommendations for 2nd round:* Since “NTN” is already part of updated WID RP-202908, the moderator has no suggestion for the WF. |
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*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

### 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 | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **TDoc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #6: NTN UL frequency synchronization requirement

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

Moderator note: this topic has been integrated from Topic#5, moderator discussion [98e][237] for RRM, as it has been decided that the subject will be considered in the RF part [98e][310].

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2100780](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100780.zip) | MediaTek Inc. | **Observation 1:** By using propagation method based on gravity with SIB periodicity of 10s:   * The frequency error is 1.23Hz, which is less than 0.001 ppm at fc = 2GHz.   **Observation 2:** By using propagation method based on linear extrapolation with SIB periodicity of 2s:   * The frequency error is 0.42Hz, which is around 0.0002 ppm at fc = 2GHz.   **Observation 4:** UL frequency error contributed by UE pre-compensate satellite Doppler is small and can meet the maximum UL frequency error of ± 0.1ppm for UL transmission.  **Proposal 2:** Keep the legacy UL frequency error requirement of ± 0.1ppm for NTN Ues. |
| [R4-2102893](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102893.zip) | Qualcomm Inc. | **Proposal 1:** RAN4 to investigate factors that can affect time/frequency pre-compensation accuracy requirements, e.g.   * Residual time/frequency error at UE side due to mobility and inaccurate position information, e.g. GNSS accuracy and frequency of reading GNSS information * Residual time/frequency error in LEO due to a fast movement of LEO and an inaccurate PVT information in terms of precision and/or update frequency (subject to higher layer design) * Residual time/frequency error in GEO if there is a non-negligible local position change * FFS on whether and what effects should be considered for feeder link * FFS on pre-compensation for HAPs and HIBS * FFS on whether and how to consider location-based UL transmission power autonomous adjustment |

## 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 6-1: Frequency accuracy requirements

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

**Issue 6-1: UL frequency error requirement**

* Proposals
  + Option 1: Keep the legacy UL frequency error requirement of ± 0.1ppm for NTN Ues.
  + Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| THALES | Sub topic 6-1: It has been already decided that this should be part of RF requirements. Please note RAN4#97e (R4-2017350): “It is agreed to have UL pre-compensation method based on GNSS. The final UE UL frequency accuracy requirement is defined in RAN4 UE RF session.”  The value is fine, but is up to RAN4 (RF) to decide. Moreover, this can be defined at both UE & probably BS/satellite level (or **as seen by gNB, and not by UE**).  In R4-2017302 it has been proposed:   1. **UE shall be able to compensate the frequency offset** due to the satellite mobility when generating its UL carrier frequency. 2. The UE modulated carrier frequency shall be accurate to within ±0.1 ppm **as observed over a period of 1 ms by the gNB.** 3. The UE residual frequency error shall be sufficiently low such that it can be considered included **in the tolerated frequency error of ±0.1 ppm already captured in the specification.**   ….  Others: |
| Qualcomm | **Issue 6-1: UL frequency error requirement**  There can be other frequency error sources in the system, e.g. frequency error at the satellite and gateway, etc. And the errors can add up. Maybe it’s okay for 2GHz frequencies. But it can be problematic for higher frequencies. |
| Apple | **Issue 6-1: UL frequency error requirement**  Shall discuss in RF session |
| Ericsson | Sub topic 6-1:  Issue 6.1: Option 1. This should be decided by the RF group. |
| Xiaomi | **Issue 6-1:**  **It shall be discussed in RF session.** |
| OPPO | **Issue 6-1:**  Up to the conclusion of RF session. |
| MediaTek | **Issue 6-1: UL frequency error requirement**  Option 1 from our view. To be decided by the RF group. |
| Huawei | **Issue 6-1: UL frequency error requirement**  This should be discussed in RF. |
| CATT | **Issue 6-1:**  It should be discussed later in RF session. |
| Nokia, Nokia Shanghai Bell | **Issue 6-1:**  This issue should be discussed in the RF session. |

All companies seem to agree to discuss UL frequency error requirement in RF session. It has been proposed to keep the legacy UL frequency error requirement of ± 0.1ppm for NTN UEs. Moderator suggests the following WF(s):

**Proposal 6-1: UE shall be able to compensate the frequency offset** due to the satellite mobility when generating its UL carrier frequency.

**Proposal 6-2:** The UE modulated carrier frequency shall be accurate to within ±0.1 ppm **as observed over a period of 1 ms by the gNB.**

**Proposal 6-3:** The UE residual frequency error shall be sufficiently low such that it can be considered included **in the tolerated frequency error of ±0.1 ppm already captured in the specification.**

## 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** |
| **Issue 6-1:**  UL frequency error requirement | All companies seem to agree to discuss UL frequency error requirement in RF session.  It has been proposed to keep the legacy UL frequency error requirement of ± 0.1ppm for NTN UEs. Moderator suggests the following WF(s):  *Tentative agreements:*  **Proposal 6-1: UE shall be able to compensate the frequency offset** due to the satellite mobility when generating its UL carrier frequency.  **Proposal 6-2:** The UE modulated carrier frequency shall be accurate to within ±0.1 ppm **as observed over a period of 1 ms by the gNB.**  **Proposal 6-3:** The UE residual frequency error shall be sufficiently low such that it can be considered included **in the tolerated frequency error of ±0.1 ppm already captured in the specification.**  *Candidate options:-*  *Recommendations for 2nd round:* Discuss proposals for 2nd round and agree if possible by the end of the meeting. |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Email discussion summary for [98e][310] NTN\_Solutions\_Part1 2nd Round | Thales, 2nd round discussion |
| #2 | Way Forward on [310] NTN\_solutions\_Part1 | Thales, WF |

### 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 | *N/A* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Updated Work Plan

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
|  |  |  |

## Discussion 1st round

|  |  |
| --- | --- |
| **NTN Work Plan** | **TDoc Status update recommendation** |
|  |  |
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Current Work Plan for current RAN4 and next RAN4 meeting:

**25 January-5 February 2021, RAN4#98-e, e-meeting**

* Agree on use cases and scenarios and exemplary band(s)
* Initial discussion on Demodulation KPIs.
* Further discussion on the RF & RRM KPIs for NTN core requirements (UE and “BS” requirements)
* Further discuss necessary simulations
* Agree on exemplary band(s)

**12-20 April 2021, RAN4#98-bis-e, e-meeting**

* Further discussion on the RF & RRM KPIs (UE and “BS” requirements)
* Further discussion on Demodulation KPIs.
* Further discuss on specific requirements associated to the selected exemplary bands as well as the necessary simulations

## Summary for 1st round

Please see current work plan reflected in **R4-2017661** (accepted).

Companies are invited to provide their feedback by email, if any.

# Appendix: Companies contribution summary

Contribution summaries are as follows:

|  |  |  |
| --- | --- | --- |
| **TDoc number** | **Company** | **Proposals / Observations** |
| [R4-2101813](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101813.zip) | Huawei, HiSilicon | **Observation 1:** In order to reduce the regulatory risk, RAN4 can start the work with a frequency band in which MSS is used without incumbent service.  **Proposal 1:** It’s proposed to choose L band as exemplary band for NTN topic.  **Observation 2:** RAN4 can further discuss the exemplary bands for HAPS based on the operators’ input. |
| [R4-2102175](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102175.zip) | Ericsson | **Proposal 1:** RAN4 should handle gateway + satellite as a repeater or relay and specify needed requirements for gateway + satellite in a new repeater or relay specification. |
| [R4-2102173](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102173.zip) | Ericsson | **Proposal 1:** The frequency ranges considered for NTN should be spectrum allocated by ITU to *Mobile satellite* as primary service.  **Proposal 2:** Spectrum allocated to Fixed satellite service should not be considered as a candidate for NTN bands.  **Proposal 3:** Investigate the ESIM use case as well as its architecture in the Fixed satellite service spectrum identified by ITU.  **Proposal 4:** NTN bands shall be either fully in FR1 or fully in FR2, but not only partly in FR1 or FR2.  **Proposal 5:** Use the proposed chunk of L-band for the first FR1 NTN band. |
| [R4-2101933](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101933.zip) | Nokia, Nokia Shanghai Bell | **Observation 1:** ITU separates spectrum for satellite and HAPS deployments in separate groups.  **Observation 2:** Reuse of terrestrial spectrum and already defined 3GPP bands for HAPS deployments will facilitate a rapid deployment of IMT systems into rural areas.  **Observation 3:** HAPS are already deployed in the LTE spectrum it should be natural also to support these deployments in NR spectrum.  **Proposal 1:** There is no need to specify any new HAPS specific bands in NTN WI but select at least one example band from the existing NR bands identified for HAPS deployment.  **Proposal 2:** To demonstrate coexistence between HAPS and TN networks, RAN4 to study at least one example band in FR1 and focus on adjacent channel issues.  **Proposal 3:** RAN 4 to choose one example NR bands in FR1 belonging to satellite spectrum, identified by ITU for IMT deployment and focus on adjacent channel issues  **Proposal 4:** RF requirements for a terrestrial gNB should be used as baseline for HAPS, LEO and GEO deployments.  **Proposal 5:** Satellites in transparent deployments should provide same performance in terms of RF characteristics.  **Proposal 6:** RAN4 to discuss how much the IAB requirements or a subset can be reused for the VSAT Terminal type in NTN.  **Proposal 7:** RAN4 to discuss whether user movement really is needed in the studies or whether speed dependent issues can be based on the LEO case without user movement. |
| [R4-2102374](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102374.zip) | HUGHES Network Systems, Thales, Inmarsat, Intelsat, Fraunhofer, ESA | **Proposal 1:** Frequency bands allocated to satellite services above 10 GHz can be treated as FR2 band for consideration by RAN4 specification work.  **Proposal 2:** “3GPP TR 38.820: NR; 7-24 GHz frequency range” can also be used as reference.  **Proposal 3:** New band definitions for NTN operating in frequencies in FR2 or FR2-like (7-24 GHz range) shall assume NTN operating in FDD mode.  **Proposal 4:** For bands above 6 GHz, “VSAT” UE including fixed/moving platform mounted ones are considered as baseline. The RF characteristics of “VSAT” UE in Table 6.1.1.1-3 in 3GPP TR 38.821 shall be assumed in the Rel-17 WI NR-NTN-solutions. |
| [R4-2101814](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101814.zip) | Huawei, HiSilicon | **Proposal 1:** RAN4 should consider (satellite + feeder link + gateway) as a NTN entity in Rel-17 from RF perspective. The corresponding UE and satellite RF requirements should be specified.  **Observation 1:** We can only consider the conducted connector in the NTN specification, if parabolic/cassegrain antenna can be used for VSAT and Satellite and omnidirectional antenna is used for handheld UE. |
| [R4-2101858](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101858.zip) | THALES | **Proposal 1:** Band characteristics (e.g. available BW, UL/DL configuration, maximum configurable BW size, coexistence conditions) of the candidate bands should be considered for comparison purposes. Note that views from operators should be taken into account in priority.   |  |  |  | | --- | --- | --- | | Parameter | Band “i” | Band “i+1” | | UL frequency band | - | - | | DL frequency band | - | - | | Maximum configurable BW size | - | - | | BW Configuration | - | - | | Coexistence conditions | - | - | | ITU Region Availability | - | - | | Others, e.g. view from operator | - | - | | - | - | - |   **Proposal 2:** RAN4 should consider at least MSS S-band as exemplary FR1 band for RAN4 coexistence scenarios. |
| [R4-2100399](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100399.zip) | CATT | **Proposal 1:** It is proposed to consider 1980-2010/2170-2200MHz for GEO satellite.  **Proposal 2:** It is proposed to consider 17.7 - 20.2 (DL) and 27.5 - 30.0 GHz (UL) for LEO satellite.  **Proposal 3:** It is proposed to consider 2GHz for HAPS as the example frequency for co-existence study.  To be considered by [98e][311] NTN\_Solutions\_Part2:  **Proposal 4:** It is proposed to focus on fixed beam scenario for satellite.  **Proposal 5:** It is proposed to consider the NTN scenarios in Table 2.2-1 for co-existence study.  **Proposal 6:** It is proposed to consider Rural and Dense urban scenario with priority for terrestrial network. |
| [R4-2100824](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100824.zip) | CMCC | **Observation 1:** Once NTN band is the same as or overlapping with IMT operating band, it is possible that the satellite and IMT operate in co-channel rather than adjacent-channel as how different mobile operators have done to avoid interference. This co-channel operation would result in destructive interference and make it hard for the actual application.  **Observation 2:** it is up to RAN plenary to decide whether to study the NTN bands falling into 7-24GHz.  **Observation 3:** The definition of HIBS is under discussion in WP5D. 3GPP could send LS to ITU for more clarifications, if needed.  **Observation 4:** HIBS could only use the spectrum allocated for IMT application while HAPS could also use spectrum allocated for fixed service.  **Observation 5:** Existing UE served by ground-based IMT base stations would also be served by HIBS to provide connection where used to be unserved such as in rural and remote areas.  **Observation 6:** ITU has performed some studies so far, including the spectrum allocation, the sharing and compatibility studies and technical conditions for protection of ground-based IMT stations. But no domestic adjacent-channel co-existence study has been performed.  **Proposal 1:** It should be emphasized that the frequency ranges considered for satellite should be spectrum allocated by ITU to satellite services on a primary basis rather than secondary basis.  **Proposal 2:** at current stage L band would be more appropriate as exemplary band for NTN considering S band may introduce harmful interference for current deployed IMT network.  **Proposal 3:** it is appropriate not identifying any FR2 exemplary bands at current stage because it is hard to seek an exemplary band completely for FR2.  **Proposal 4:** it is suggested to replace the terminology “HAPS” by “HIBS” because the stations deployed in HPAS is not limited to IMT BS. Once the stations are not IMT compatible, new interface, physical channel and signal process procedure are all required to be updated.  **Proposal 5:** It is suggested to focus on NTN study. if time is allowed HIBS could be included in NTN scope. |
| [R4-2100905](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100905.zip) | Samsung | **Proposal 1:** Prefer only 1 exemplary band for FR1 to minimize the work load of RAN4, and prefer S-band (1980-2010/2170-2200MHz) as the exemplary band.  **Proposal 2:** Deprioritize FR2 exemplary band at this stage. |
| [R4-2100111](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100111.zip) | THALES | **Proposal 1:** The following aspects should be considered out of scope of 3GPP since they are implementation dependent:   * The fronthaul interface between the NTN-gateway and the gNB-DU. It is similar to the interface between gNB-DU and RRH. It may be a wire-line connection (e.g. Optical fibre, Ethernet cable, RF cable, ..). * The NTN vehicle may be specific to each NTN infrastructure. * The NTN-Gateway, which is a transport node (RAN3 agreement). * The feeder link, which is transporting the NR-Uu interface. * The NTN control function to control the NTN-vehicle(s) as well as the radio resources of the NTN payload(s).   **Proposal 2:** As part of the Rel-17 WI NR-NTN-solutions, 3GPP RAN4 should focus its work on the RF requirements at the service link level of the gNB including the NTN-RRH |
| [R4-2100487](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100487.zip) | CATT | **Proposal 1:** Treat NTN Payload + NTN GW as a single entity (repeater or relay) and focus only on the service link in RAN4 requirement development.  **Proposal 2:** Develop Repeater-type requirement for NTN in Rel-17.  **Proposal 3:** The reference point for NTN requirements and the test method need to be clarified. |
| [R4-2101859](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101859.zip) | THALES | **Proposal 6:** Based on simulation and evaluation results for described NTN-TN coexistence scenarios in adjacent bands, work may further consider relaxing some of satellite RF parameters such as satellite ACLR and ACS. |
| [R4-2102176](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102176.zip) | Ericsson | It should be noted that at least for FR1 where gateway can interface the gNB, conducted type of requirements can be used while for access part i.e. when satellite interfaces the UE, there is a need to develop proper OTA requirements.  In this contribution, a brief overview of requirement structure based on proposed approach i.e. handling gateway+ satellite as either repeater or relay was discussed.  As relay requirements are more comprehensive, if there is additional processing occurs within either gateway or satellite, using the relay is to prefer. It is essential to conclude on how to handle the gateway + satellite to progress further work. |
| [R4-2100780](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100780.zip) | MediaTek Inc. | **Observation 1:** By using propagation method based on gravity with SIB periodicity of 10s:   * The frequency error is 1.23Hz, which is less than 0.001 ppm at fc = 2GHz.   **Observation 2:** By using propagation method based on linear extrapolation with SIB periodicity of 2s:   * The frequency error is 0.42Hz, which is around 0.0002 ppm at fc = 2GHz.   **Observation 4:** UL frequency error contributed by UE pre-compensate satellite Doppler is small and can meet the maximum UL frequency error of ± 0.1ppm for UL transmission.  **Proposal 2:** Keep the legacy UL frequency error requirement of ± 0.1ppm for NTN Ues. |
| [R4-2102893](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102893.zip) | Qualcomm Inc. | **Proposal 1:** RAN4 to investigate factors that can affect time/frequency pre-compensation accuracy requirements, e.g.   * Residual time/frequency error at UE side due to mobility and inaccurate position information, e.g. GNSS accuracy and frequency of reading GNSS information * Residual time/frequency error in LEO due to a fast movement of LEO and an inaccurate PVT information in terms of precision and/or update frequency (subject to higher layer design) * Residual time/frequency error in GEO if there is a non-negligible local position change * FFS on whether and what effects should be considered for feeder link * FFS on pre-compensation for HAPs and HIBS   FFS on whether and how to consider location-based UL transmission power autonomous adjustment |