**3GPP TSG-RAN WG4 Meeting # 98-e R4-210xxxx**

**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.

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

* 1. Solutions for NR to support non-terrestrial networks (NTN) [NR\_NTN\_solutions]
		1. General and work plan [NR\_NTN\_solutions-Core]
		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 **14** 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 |

*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: Deployment Scenarios in FR1
	+ Note: e.g. Satellite constellations (GEO, LEO), UE mobility, FR used by GEO, FR used by LEO, Rural/Urban scenarios, focus on adjacent channel issues.
* Issue 1-2: Deployment Scenarios outside FR1
	+ Note: e.g. Satellite constellations (GEO, LEO), UE mobility, FR used by GEO, FR used by LEO, Rural/Urban scenarios, focus on adjacent channel issues.
* Issue 1-3: IAB Requirements Discussion for VSAT
* Issue 1-4: UE Mobility Discussion
	+ UE mobility for FR1
	+ UE mobility for outside FR1
* Issue 1-5: FSS and ESIM
* Issue 1-6: UE-Type assumptions for FR1 (#97e)
	+ proposals from general agenda – to be further considered in the coexistence discussion.
* Issue 1-7: 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 1-8: FR1 exemplary frequency band
	+ Issue 1-9: Inclusion of additional NR bands
	+ Issue 1-10: Frequency ranges allocated by ITU
	+ Issue 1-11: 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
	+ 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 criteria
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 10 GHz
* Issue 4-3: Consideration of Bands for NTN in 7-24 GHz Range
* Issue 4-4: Potential 3GPP References for Bands outside FR1/FR2
* Issue 4-5: NTN Operation Mode in Bands outside 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

# 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 Deployment Scenarios in FR1

*Sub-topic description*

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

**Issue 1-1: Deployment Scenarios in FR1**

* Proposals
	+ Option 1: LEO constellation with omnidirectional UE, and GEO constellation with UE with directional (or external) antenna, underserved/unserved (e.g. rural scenarios)
	+ Option 2: Follow TR 38.821 deployment scenarios
* Recommended WF
	+ To continue discussion in [98e][311] NTN\_Solutions\_Part2 for coexistence scenarios.

### Sub-topic 1-2 Deployment Scenarios outside FR1

*Sub-topic description*

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

**Issue 1-2: Deployment Scenarios outside FR1**

* Proposals
	+ Option 1: LEO and GEO, with UE with directional (or external) antenna, rural and urban scenarios
	+ Option 2: Follow TR 38.821 deployment scenarios
* Recommended WF
	+ To continue discussion in [98e][311] NTN\_Solutions\_Part2 for coexistence scenarios.

### Sub-topic 1-3 IAB Requirements Discussion for VSAT

*Sub-topic description*

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

**Issue 1-3: 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.

### Sub-topic 1-4 UE Mobility Discussion

*Sub-topic description*

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

**Issue 1-4: 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.

### Sub-topic 1-5 FSS and ESIM

*Sub-topic description:*

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

**Issue 1-5: 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 considerered.
	+ Option 2: 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 considerered. ESIM use case shall be further investigated, allocated FSS spectrum to ESIM is FFS for NTN bands.
	+ Option 3: Spectrum allocated to fixed satellite as primary service should **be** considered as a candidate for NTN bands.
* Recommended WF
	+ ESIM are meant to operate in FSS:
		- ESIM is FSS, however
		- Not all FSS operate ESIM (only some portions of FSS can do ESIM)
	+ Investigate the ESIM use case as well as its architecture in the FSS spectrum identified by ITU.

### Sub-topic 1-6 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 1-6: 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.”

### Sub-topic 1-7 UE-Type assumptions for outside FR1

*Sub-topic description*

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

**Issue 1-7: 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.”

### Sub-topic 1-8 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 1-8: 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.

**Issue 1-9: 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.

**Issue 1-11: 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.

## Companies views’ collection for 1st round

### Open issues

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS TDoc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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 | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## 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. |
| [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 (satellite + feeder link + gateway+gNB) as a single NTN entity in Rel-17 from RF perspective.
	+ Option 3: RAN4 should consider the gNB as including (satellite + feeder link + gateway) in Rel-17 from RF perspective.
* Recommended WF:
	+ Further discuss & decide the NTN entity to be considered from RF perspective.

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

* Proposals:
	+ Option 1: Satellite-FeederLink-Gateway as Relay
	+ Option 2: Satellite-FeederLink-Gateway as Repeater
	+ Option 3: Satellite-FeederLink-Gateway as RRH
* Recommended WF:
	+ Further discuss differences between Repeater/Relay/RRH (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).
	+ A hybrid option can be also envisaged, e.g. consider Repeater or RRH but specify only Service Link requirements.

### 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
	+ Option 2: BS requirements at gNB
	+ Option 3: BS requirements at both satellite and gNB
* 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).

### 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.

### 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).

## Companies views’ collection for 1st round

### Open issues

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS TDoc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## 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.**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 risks4. 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 n652. The available channel bandwidth is not enough. |
|  |  |  |

* Recommended WF:
	+ Integrate all values/opinions in Option 1, and then decide.

### 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

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

*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 criteria**

* Proposals:
	+ Option 1: Consider potential GNSS in-device coexistence issue for the exemplary band selection
	+ Option 2: Do not consider potential GNSS in-device coexistence issue for the exemplary band selection
* Recommended WF:
	+ Priority in Rel-17 should be given for exemplary band that has no potential GNSS in-device coexistence issue.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 3-1: Sub topic 3-2:….Others: |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS TDoc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## 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. |

 |
|  |  |  |

## 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

### Sub-topic 4-4 Potential 3GPP References for Bands outside FR1/FR2

*Sub-topic description*

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

**Issue 4-4: 3GPP potential references outside FR1/FR2**

* Proposals:
	+ Option 1: “3GPP TR 38.820: NR; 7-24 GHz frequency range” can also be used as reference.
	+ Option 2: TBA
* Recommended WF:
	+ Consider at least “3GPP TR 38.820: NR; 7-24 GHz frequency range” as useful reference.

### Sub-topic 4-5 NTN Operation Mode in Bands outside FR1

*Sub-topic description*

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

**Issue 4-5: NTN Operation Mode outside FR1**

* Proposals:
	+ Option 1: FDD
		- New band definitions for NTN operating in frequencies in FR2 or FR2-like (7-24 GHz range) shall assume NTN operating in FDD mode.
* Recommended WF:
	+ Consider FDD for NTN Operation Mode

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 4-1: Sub topic 4-2:….Others: |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS TDoc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## 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.

### 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
	+ TBA

### 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

**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

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 5-1: Sub topic 5-2:….Others: |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS TDoc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## 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”* |

# Updated Work Plan

## Companies’ contributions summary

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

## Discussion 1st round

|  |  |
| --- | --- |
| **NTN Work Plan** | **TDoc Status update recommendation**  |
|  |  |
|  |
|  |
|  |

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. |
|  |  |  |
|  |  |  |