**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2105978**

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 8.8.1, 8.8.1.1, 8.8.1.2, 8.8.1.3

**Source:** Moderator (THALES)

**Title:** Email discussion summary for [98-bis-e][307] NTN\_Solutions\_Part1

**Document for:** Information

# Introduction

This discussion summary document captures general issues related to RAN4 RF part Rel-17 NR NTN WI, including system parameters, NTN architecture, and regulatory discussions, including exemplary bands. It contains a summary of the contributions under sections and subsections 8.8.1, 8.8.1.1, 8.8.1.2, 8.8.1.3 at TSG-RAN WG4 #98-bis-e, together with identified key open issues and recommends topics/questions to be handled via email discussions. The goal of this document is to provide recommendation on prioritization of discussion.

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

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

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

\* Include candidate band discussion for FR2

### 8.8.1.1 System parameters [NR\_NTN\_solutions-Core]

### 8.8.1.2 NTN architecture [NR\_NTN\_solutions-Core]

### 8.8.1.3 Regulatory information [NR\_NTN\_solutions-Core]

### 8.8.1.4 Others [NR\_NTN\_solutions-Core]

### 8.8.2 Coexistence aspects [NR\_NTN\_solutions-Core]

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

### 8.8.2.2 Simulation results [NR\_NTN\_solutions-Core]

### 8.8.3 RF requirements [NR\_NTN\_solutions-Core]

### 8.8.3.1 Network side requirements [NR\_NTN\_solutions-Core]

### 8.8.3.2 UE requirements [NR\_NTN\_solutions-Core]

### 8.8.4 RRM core requirements [NR\_NTN\_solutions-Core]

### 8.8.4.1 General [NR\_NTN\_solutions-Core]

### 8.8.4.2 Timing requirements [NR\_NTN\_solutions-Core]

### 8.8.4.3 Measurement requirements [NR\_NTN\_solutions-Core]

For informative purpose, RAN4#98-bis-e E-meeting Arrangements and Guidelines proposed the following schedule:

* Stage 1: Moderators kick off email discussion (Monday Apr. 12)
* Stage 2: Companies provide comments for the 1st round (Apr. 12 – Wednesday 8am UTC Apr. 14)
* Stage 3: Moderators summarize the status and possible proposals, recommending what decisions can be made for 1st round. A formal t-doc will be used (Wednesday 11pm UTC, Apr. 14)
* 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 Friday 3pm UTC, Apr. 16)
* Stage 5: Companies provide comments for 2nd round starting from Thursday 8am UTC Apr. 15.
  + - Draft WF/LS and revised CRs/TPs shall be shared by Friday 11pm UTC, Apr. 16.
    - Commenting shall stop by Monday 11pm UTC, Apr. 19.
    - Formal tdocs of WF/LS/CRs/TPs shall be uploaded to the Inbox (except Cat A CRs) by Tuesday 1am UTC, Apr. 20.
* Stage 6: Moderators provide 2nd round summary with a formal tdoc by Tuesday 9am UTC, Apr. 20.
* Stage 7: Session chairs announce close of sessions (no later than 5pm UTC, Apr. 20). Final decisions will be captured in Chairman meeting report (to be shared after the meeting is closed)

A total of **11** TDocs have been identified for this agenda (please also see the **Annex** for the details, with all the observations/proposals):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company*** | ***Status*** | ***General Purpose*** | ***Agenda Item*** |
| [R4-2104879](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104879.zip) | Work Plan | NR\_NTN\_solutions work plan | THALES | available | Endorsement | 8.8.1 |
| [R4-2107217](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107217.zip) | discussion | On the FR2 NTN coexistence scenarios | Hughes/EchoStar, Inmarsat, Thales, ESA, Intelsat | available | Discussion | 8.8.1 |
| [R4-2107193](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107193.zip) | discussion | On NTN System parameters | Nokia, Nokia Shanghai Bell | available | Approval | 8.8.1.1 |
| [R4-2106607](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106607.zip) | other | Discussion on system parameters for NTN | ZTE Corporation | available | Approval | 8.8.1.1 |
| [R4-2106899](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106899.zip) | other | Reference points and reference model for NTN | Ericsson | available | Approval | 8.8.1.1 |
| [R4-2106608](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106608.zip) | other | Discussion on NTN architecture | ZTE Corporation | available | Approval | 8.8.1.2 |
| [R4-2106545](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106545.zip) | other | Discussion on RF interfaces for NR to support non-terrestrial networks | Xiaomi | available | Approval | 8.8.1.2 |
| [R4-2106686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106686.zip) | other | Further discussion on Network architecture on NTN system | Huawei, HiSilicon | available | Approval | 8.8.1.2 |
| [R4-2104808](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104808.zip) | discussion | on NTN architecture and RF requirements | CATT | available | Discussion | 8.8.1.2 |
| [R4-2107263](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107263.zip) | discussion | NTN Architecture Aspects | THALES | available | Discussion | 8.8.1.2 |
| [R4-2106897](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106897.zip) | other | NTN - Regulatory and spectrum aspects | Ericsson | available | Approval | 8.8.1.3 |

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

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

Identified topics and issues for the 1st round:

1. Topic #1: NTN Architecture Aspects
   1. Issue 1-1: Architecture options from RAN4#98e
   2. Issue 1-2: Potential (architecture type) selection process
   3. Issue 1-3: Use architecture as defined by RAN3 as baseline for RAN4
   4. Issue 1-4: Type of connexion between NTN-Gateway and Non-NTN Infrastructure gNB functions
   5. Issue 1-5: <satellite+feeder link+ NTN-gateway> as a RRU, Relay, Repeater
2. Topic #2: Generic Parameters
   1. Issue 2-1: gNB hypotheses for the ground gNB component in NTN
   2. Issue 2-2: NTN GW parameters/requirements
   3. Issue 2-3: New TS capturing the radio transmission and reception requirements for the NTN-Payload.
3. Topic #3: FR1 Generalities
   1. Issue 3-1: Possible band configuration for S-band

Note: discussion can be separated from coexistence parameters for [98-bis-e][308] NTN\_Solutions\_Part2

* 1. Issue 3-2: [Option not clear]Band definition/combinations for S-band

Note: discussion can be separated from coexistence parameters for [98-bis-e][308] NTN\_Solutions\_Part2

* 1. Issue 3-3: Channel raster for S-band
  2. Issue 3-4: Possible band configuration for L-band

Note: discussion can be separated from coexistence parameters for [98-bis-e][308] NTN\_Solutions\_Part2

* 1. Issue 3-5: Band definition/combinations for L-band

Note: discussion can be separated from coexistence parameters for [98-bis-e][308] NTN\_Solutions\_Part2

* 1. Issue 3-6: Channel raster for L-band
  2. Issue 3-7: De-scope NTN-NTN scenarios in FR1
  3. Issue 3-8: [option not clear] Identify one existing FR1 NR band for satellite deployment for use in coexistence studies

1. Topic #4: FR2 Generalities
   1. Issue 4-1: Consider Ka band for coexistence simulations
   2. Issue 4-2: Consider Ka band as exemplary band
   3. Issue 4-3: Allocated spectrum type for NTN
2. Topic #5: HAPS Aspects
   1. Issue 5-1: FR1 NR band for HAPS deployment for use in coexistence studies.
   2. Issue 5-2: NR band n1 as example band for HAPS related coexistence studies.
   3. Issue 5-3: Separate HAPS (NTN-TN and/or NTN-NTN) coexistence scenarios from Satellite (NTN-TN and/or NTN-NTN) coexistence scenarios
3. Topic #6: Updated Work Plan

Note: Work Plan aspects

# Topic #1: NTN Architecture Aspects

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2106899](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106899.zip) | Ericsson | In this contribution, a brief overview of NTN system reference model and reference points was discussed, and a reference model based on handling of “gateway + satellite” as repeater was proposed.    Figure 1 NTN overview architecture and gNB and UE reference points  **Observation1: Test set ups and procedure shall be clearly described in conformance specifications. Keeping GTW+satellite as a separate repeater node would help doing this.**  **Proposal 1: RAN4 should handle gateway + satellite as a repeater and specify needed requirements for gateway + satellite in a new NTN repeater specification.** |
| [R4-2106608](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106608.zip) | ZTE Corporation | **Observation 1: if NTN gateway is cable connected with gNB, then satellite+feeder link+ NTN-gateway would work similar as legacy RRU.**  **Observation 2: if NTN gateway without baseband capability is wireless connected with gNB, then satellite+feeder link+ NTN-gateway would work as simple repeater;**  **Observation 3: if NTN gateway with baseband capability is wireless connected with gNB, then satellite+feeder link+ NTN-gateway would work as relay;**  **Proposal: consider the following diagram to define requirements for NTN network requirements.** |
| [R4-2106545](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106545.zip) | Xiaomi | Option 1  Option 2  Figure 1, two candidate options  **Proposal 1: it is preferred to consider Satellite + feeder link + NTN-Gateway + gNB as a single entity (option 2)**  **Proposal 2: no need to define RF requirements for the linkage between NTN-Gateway and gNB** |
| [R4-2106686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106686.zip) | Huawei, HiSilicon | Figure 2 User plane Protocol stack (Transparent satellite) - Clause 5.1 TR 38.821    Figure 3 Control plane Protocol stack (Transparent satellite) - Clause 5.1 TR 38.821  It can be found that the Uu interface was not assumed between NTN gateway and gNB.  **Observation 1: Different implementations between NTN-Gateway and gNB can’t be excluded, such as wireless solution, RF cable and optical fiber.**  **Observation 2: Based on the outcome during the Study Phase, Uu interface was not assumed between NTN gateway and gNB.**  **Proposal 1: There is no need to define the RF requirements for the linkage between NTN-Gateway and gNB.**  **Proposal 2: RAN4 can consider (Satellite + feeder link + NTN-Gateway + gNB) as a single entity.** |
| [R4-2104808](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104808.zip) | CATT | In last RAN3 meeting, the following networking-RAN architecture has been included in 38.300 for NTN. It is apparent that Satellite + feeder link + NTN-Gateway + gNB as a single entity is treated as single entity. This entity is seen as a black box without any interface standardized between the components.    Figure 1: Networking-RAN architecture with transparent satellite  **Observation: Satellite + feeder link + NTN-Gateway + gNB is treated as a single entity, which means Option 2 in [1] is correct understanding.**  **Proposal 1: Treat Satellite + feeder link + NTN-Gateway + gNB as a single entity (black box).**  **Observation 2: RF requirement is not possible to be specified between the components within the black box due to lack of standard interface.**  **Proposal 2: It is proposed that no RF requirement is defined for the linkage between NTN-Gateway and gNB. RAN4 should focus on defining RF requirement for service link only.**  **Proposal 3: It is proposed to only specify BS-alike requirements for NTN.** |
| [R4-2107263](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107263.zip) | THALES | **RAN4#98-e 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 + feeder link + NTN-Gateway as a single entity**   + **Option 2: Satellite + feeder link + NTN-Gateway + gNB as a single entity** * **FFS whether RAN4 shall define RF requirements for the linkage between NTN-Gateway and gNB**   + **Companies are encouraged to further clarify and discuss the assumption of the linkage between NTN-Gateway and gNB**   **Proposal 1:** RAN4 should not consider (Satellite + feeder link + NTN-Gateway) as a NR Relay.  Currently RAN4 has decided not to provide any RRM requirements in Rel-17 for the Repeater specifications.  **RAN4#98-e Agreements:**   * In addition, the following agreements regarding overall work were captured in the chairman meeting minutes: * RRM is out of scope based on current WID.   …   * Fixed antenna gain and pattern is assumed   **Proposal 2:** RAN4 should not consider (Satellite + feeder link + NTN-Gateway) as a NR Repeater.  **Proposal 3:** The interface between the NTN-GW and the Non-RF gNB functions is neither radiated nor conducted RF carrier.  Some architecture principles in the draft stage 2 Baseline CR (see R3-211344) have been agreed at RAN3#111-e. In line with these principles, the following figure has been provided to illustrate an example implementation of a Non-Terrestrial Network within an NG-RAN infrastructure for transparent NTN payload:    Figure B-1: NTN based NG-RAN  From the above, the following observations can be made:  **Observation 1:** The NTN-Payload, feeder link and NTN-Gateway forms a single entity called the “NTN Service link provisioning system”.  **Observation 2:** The gNB encompasses both the “NTN Service link provisioning system” and the “non NTN infrastructure gNB functions”.  **Observation 3:** The linkage between the “NTN Service link provisioning system” and the “non NTN infrastructure gNB functions” is not defined by RAN3.  **Proposal 4**: RAN4 to develop new TS capturing the radio transmission and reception requirements for the NTN-Payload.  **Observation 4:** The linkage between NTN-Gateway and modems is expected to be typically implemented with a wired connection (not necessarily RF).  **Proposal 5:** The definition of RF requirements for the linkage between NTN-Gateway and gNB should be optional and therefore can be deprioritised. |

## 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

*Sub-topic description:*

**RAN4#98-e 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 + feeder link + NTN-Gateway as a single entity**
  + **Option 2: Satellite + feeder link + NTN-Gateway + gNB as a single entity**

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

**Issue 1-1:** Architecture options from RAN4#98e

* Proposals
  + Option 1: **Satellite + feeder link + NTN-Gateway** as a single entity
  + Option 2: **Satellite + feeder link + NTN-Gateway + gNB** as a single entity
* Recommended WF
  + TBA

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes |
| CATT |  | Yes |
| **Ericsson** | **Yes**  This architecture split will not impact existing BS specifications, keeping full flexibility for implementation on satellite’s side. Also, it will simplify testing a lot: the RF requirements for the satellite node will be limited to Tx, no Rx ones. | **No**  No proposal has been made to address our testing concerns with this option, how conformance aspects will be specified, including test set up… |
| Intelsat |  | Yes |
| **ESA** |  | **Yes (preferable solution)** |
| **Eutelsat** |  | **Yes** |
| **OPPO** | **Yes, same view as Ericsson on the requirements aspect.** |  |
| **ZTE** | Both option 1 and option 2 should be allowed. | Both option 1 and option 2 should be allowed. |
| **Inmarsat** | Both options are potentially viable. However, it would seem that this option would require further specification of the feeder link interface and RRM, which could constitute additional scope. | **Preferred** Both options are potentially viable, however, if prioritization/down-scoping is required, Option 2 is preferred as it appears to have the least complexity. There is no real need to specify NTNGW-gNB interface.  We like the observations captured by ZTE proposal. |
| Fraunhofer |  | Agree with Inmarmsat |
| Hughes/EchoStar | Yes |  |
| Xiaomi |  | Yes |
| CMCC | Yes, share the same views with Ericsson |  |
| Nokia | Yes |  |
| Huawei |  | Yes |
| Qualcomm |  | Yes |

The proposals were:

* + Option 1: **Satellite + feeder link + NTN-Gateway** as a single entity
  + Option 2: **Satellite + feeder link + NTN-Gateway + gNB** as a single entity

The summary is as follows:

* 5 companies prefer Option 1
* 10 companies prefer Option 2
* 1 company prefers both Option 1 and Option 2

Majority seems in the favour of Option 2, but no clear decision can be reached. As suggested by some companies, **it has to be further clarified if there is a real need to specify GW-gNB interface.**

**Proposal 1-1:** RAN4 shall **further clarify if there is a real need to specify GW-gNB interface.**

**Proposal 1-2:** RAN4 to decide if there are any testing concerns for **Satellite + feeder link + NTN-Gateway + gNB as a single entity,** and why.

It is claimed that Option 1 will simplify testing a lot, since the RF requirements for the satellite node will be limited to Tx, no Rx ones. However, it seems that:

If **Satellite + feeder link + NTN-Gateway + gNB** as a single entity, RAN4 will have to test 1 entity.

If **Satellite + feeder link + NTN-Gateway** as a single entity, RAN4 will have to test at least 2 entities.

**Proposal 1-3:** RAN4 shall further clarify which one of the Options (**Satellite + feeder link + NTN-Gateway** as a single entity, or **Satellite + feeder link + NTN-Gateway + gNB** as a single entity) is easier to test in Rel-17 from RAN4 point of view.

It also seems that:

If **Satellite + feeder link + NTN-Gateway + gNB** as a single entity, RAN4 will have to specify 1 RFs (Satellite).

If **Satellite + feeder link + NTN-Gateway** as a single entity, RAN4 will have to specify at least 2 RFs (Satellite and GW).

**Proposal 1-4:** RAN4 shall further clarify which one of the Options (**Satellite + feeder link + NTN-Gateway** as a single entity, or **Satellite + feeder link + NTN-Gateway + gNB** as a single entity) is easier to specify in Rel-17 from RAN4 point of view.

### Sub-topic 1-2

*Sub-topic description*

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

**Issue 1-2:** Potential (architecture type) selection process

* Proposals
  + Option 1: Consider the following diagram to define requirements for NTN



* + Option 2: Other
* Recommended WF
  + Option 1

**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 | Agree with Option 1 |
| CATT | Disagree | It is implementation issue whether it is wired connection or wireless connection. It’s hard to develop requirement by assuming a specific implementation. |
| Ericsson | Partially agree | Would that mean we will specify 3 NTN core specifications? The first criteria (cable connected or not) might not be relevant: we could have “RF cable” and still select NTN as Repeater. |
| Intelsat | Agree | Agree with Option 1 |
| Eutelsat | Agree | Option 1 |
| OPPO | Disagree | It is better to firstly agree on how the requirements for the NTN system look like and which part of this system is tested, etc. |
| ZTE | Agree | The proposal is mainly to give the full picture how the implementation impacts on the RF requirement indeed. |
| Inmarsat | Agree | Option 1 |
| Fraunhofer | Agree | Same view as ZTE |
| Hughes/EchoStar | Agree | Same view as ZTE and Fraunhofer |
| Xiaomi | Partially agree | We suggest to focus on service link as priority. |
| CMCC |  | Above diagram is very helpful to understand the role that NTN gateway and gNB would play. But we are confused about the motivation of such diagram. Do we need to define different RF requirements according to whether there is a cable/baseband processor or not? But from understanding, the RF requirement should be independent on the architecture. More clarification is needed about the motivation of above diagram. |
| Nokia | Agree partially | We do believe that NTN-GW interface (what signalling) to/from the gNB should be specified and standardised. However, option 1 might need further consideration |
| Huawei | Disagree | We have an agreement that we just focus on service link in REL-17 NTN Topic. So we don’t need to consider the Gateway. |
| Qualcomm | Disagree | Can companies explain more on what is the baseband capability that in NTN gateway? Does it mean we will have 3 NTN spec? The interface between NTN gateway and gNB depends in the implementation. No need to define/test the requirements for the NTN gateway and gNB interface. |

With respect to the proposed/recommended WF, the summary is as follows:

* 7 companies Agree
* 4 companies Partially Agree
* 4 company Disagree

No clear decision. The figure can be modified accordingly and resubmitted. Moreover:

* It has to be further clarified if there is a real need to specify GW-gNB interface.
* It has been also mentioned that “is implementation issue whether it is wired connection or wireless connection” between the GW and the gNB.

Moderator therefore suggests the following modifications for the WF:

**Proposal 1-5: RAN4 RF shall focus on NTN service link as priority.**

**Proposal 1-6: Is implementation issue whether it is wired connection or wireless connection between the GW and the gNB.**

**Proposal 1-7: RAN4 shall prioritize only one potential implementation for GW-gNB interface in Rel-17.**

### Sub-topic 1-3

*Sub-topic description*

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

**Issue 1-3:** Use architecture as defined by RAN3 as baseline for RAN4

* Proposals
  + Option 1: Use architecture as defined by RAN3 as baseline for RAN4



Figure B-1: NTN based NG-RAN

* + Option 2: Other
* Recommended WF
  + Follow RAN3 architecture agreements as baseline for RAN4

**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 | Option 1 which was agreed in RAN3. |
| CATT | Agree |  |
| Ericsson | Disagree | RAN3 architecture is fully independent of RAN4 choice: reading carefully R3-211344, under figure 4.x-1, there is a note clearly stating this: “Figure 4.x-1 depicts the logical architecture of an NTN; RAN4 aspects are out of scope.”  There is no reason to align with RAN3 architecture then. |
| Intelsat | Agree | Option 1 as agreed in RAN3 |
| ESA | Agree | Option 1 is agreed in RAN3 |
| Eutelsat | Agree | Option 1 (this option has been agreed already in RAN3). |
| OPPO | Partially agree | Architecture is ok but when it comes to requirements, it needs to be agreed which part of the system need to be tested in RAN4. |
| ZTE | Disagree | Similar view as Ericsson. |
| Fraunhofer | Agree |  |
| Hughes/EchoStar | Agree |  |
| Xiaomi | Partially agree | In our view, RAN3 is just a implementation example. |
| CMCC |  | understand Ericsson’s concern. however, since there is no agreed RAN4 architecture, maybe RAN3’s architecture agreement could be taken as baseline and the potential modification is allowed. |
| Nokia | Agree | The term ‘non-NTN infrastructure functions’ probably needs further clarification, also in RAN3 |
| Huawei | Partially agree | Same view with CMCC. It isn’t RAN4’s agreement, but we can consider it as baseline. |
| Qualcomm | Agree |  |

With respect to the proposed/recommended WF, the summary is as follows:

* 10 companies Agree
* 3 companies Partially Agree
* 2 company Disagree

It seems that the majority of the companies prefers “Agree”.

It is also important to mention that since there is no agreed RAN4 architecture, maybe RAN3’s architecture agreement could be taken as baseline and the potential modification is allowed. Clarifications are required with respect to the RAN4 aspects which are out of scope.

The architecture can be also consider as baseline for test setup.

Since we need to start to work from something, moderator suggests the following modifications for the WF:

**Proposal 1-8: RAN4 shall consider the architecture** defined by RAN3 **as baseline** and **shall allow further potential modifications if required.**



Figure B-1: NTN based NG-RAN

**Proposal 1-9: RAN4 shall consider the architecture** defined by RAN3 **as baseline** for test setup**.**

### Sub-topic 1-4

*Sub-topic description*

**RAN4#98-e Agreements:**

* **FFS whether RAN4 shall define RF requirements for the linkage between NTN-Gateway and gNB**
  + **Companies are encouraged to further clarify and discuss the assumption of the linkage between NTN-Gateway and gNB**

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

**Issue 1-4:** Type of connexion between NTN-Gateway and Non-NTN Infrastructure gNB functions

* Proposals
  + Option 1: The linkage between NTN-Gateway and Non-NTN Infrastructure gNB functions is expected to be typically implemented with a **wired connection**
  + Option 2: The linkage between NTN-Gateway and Non-NTN Infrastructure gNB functions is expected to be typically implemented with a **non-wired connection**
* Recommended WF
  + TBA

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | **Yes** |  |
| CATT | Typically yes. But it is implementation issue. |  |
| **Ericsson** | Both options should be possible. | Both options should be possible. |
| Intelsat | **Yes** |  |
| **ESA** | **YES** | **YES** |
| **Eutelsat** | **Yes** |  |
| **OPPO** | **Not sure of this question here, is it intended to limit the implementation between gNB and NTN gateway?** |  |
| **ZTE** | Both options should be feasible | Both options should be feasible |
| **Inmarsat** | Both options should be possible. This proposal is unclear, “non-NTN infrastructure functions” is a bit vague and overall the decisions seem at odds with previous topic proposals.  It should be specified exactly what this refers to. | Both options should be possible. This proposal is unclear, “non-NTN infrastructure functions” is a bit vague and overall the decisions seem at odds with previous topic proposals.  It should be specified exactly what this refers to. |
| **Hughes/EchoStar** | Yes | Yes |
| **Xiaomi** | Yes | Yes |
| **CMCC** | OK for us | OK for us |
| Nokia | Maybe, first it should be clarified what exactly this link needs to transport? Uu only? If the gNB has wired/optical connection the interface can still be defined. |  |
| **Huawei** | Yes |  |
| **Qualcomm** | What’s the typical implementation, wired or non-wired? Need input from companies. RAN4 could make the down-select.  What’s the reference point to define/test the requirements for Option 1? Should it only be for NTN-payload? |  |

With respect to the Options 1 and 2, it seems that both options are feasible and Option 1 is agreeable:

* Option 1: The linkage between NTN-Gateway and Non-NTN Infrastructure gNB functions is expected to be typically implemented with a **wired connection**
* Option 2: The linkage between NTN-Gateway and Non-NTN Infrastructure gNB functions is expected to be typically implemented with a **non-wired connection**

The summary is as follows:

* 12 companies consider both Options 1 & 2 are possible,
* 6 companies prefer Option 1 (and suggest this is the typical implementation),
* 2 companies ask for typical implementation.

All companies that selected Option 2 also selected Option 1. Therefore, it seems that there might be a potential agreement for Option 1. Moderator suggests the following proposals for the WF:

**Proposal 1-10: RAN4 shall take into account the inputs from companies to decide if the typical satellite implementation considers wired or non-wired connection with the GW.**

**Proposal 1-11: RAN4 shall prioritize** the **wired connection** between NTN-Gateway and Non-NTN Infrastructure gNB functions in Rel-17.

### Sub-topic 1-5

*Sub-topic description*

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

**Issue 1-5:** <satellite+feeder link+ NTN-gateway> as a RRU, Relay, Repeater

* Proposals
  + Option 1: RAN4 **should not consider** (Satellite + feeder link + NTN-Gateway) as a NR Repeater.

**Note 1:** no RF requirement is defined for the linkage between NTN-Gateway and gNB

**Note 2:** satellite+feeder link+ NTN-gateway would work similar as legacy RRU.

* + Option 2: RAN4 **should consider** (Satellite + feeder link + NTN-Gateway) as a NR Repeater.

**Note 1:** need to define the RF requirements for the linkage between NTN-Gateway and gNB.

* Recommended WF
  + The definition of RF requirements for the linkage between NTN-Gateway and gNB should be optional and therefore can be deprioritised.

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes  Please also see the following agreements for the NR Repeater:  **RAN4#98-e Agreements:**   * RRM is out of scope based on current WID.   …   * Fixed antenna gain and pattern is assumed |  |
| CATT | Yes. | No interface between NTN Gateway and gNB. It is not known how to treat it as NR repeater. |
| **Ericsson** | To Thales: why referring to this agreement?  I guess you are referring to NR Repeater (not NTN NR Repeater) agreement, but that’s a different WI… | **Yes**  For the same reasons as 1--1. This topic is redundant with 1-1 actually. |
| Intelsat | Yes |  |
| **Eutelsat** | **Yes** |  |
| **ZTE** | **More discussion might be needed on which link and to define which kind of requirement, sometimes, just referring to repeater or not might be not enough.** | **More discussion might be needed on which link and to define which kind of requirement, sometimes, just referring to repeater or not might be not enough** |
| **Inmarsat** | As stated above both options should be possible, but it is not a priority. We agree with the proposed WF that this should be optional and thus probably deprioritized. | As stated above both options should be possible, but it is not a priority. We agree with the proposed WF that this should be optional and thus probably deprioritized. |
| **Hughes/EchoStar** | **Agree with Way Forward** |  |
| **THALES to Ericsson** | One of the reasons for which we cannot use the current NR Repeater WI for NTN is related to RAN4#98e decision that the RRM will not be specified in Rel-17 for the NR Repeater. Please check [R4-2107263](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107263.zip" \t "_blank).  We will therefore take an important risk to consider (Satellite + feeder link + NTN-Gateway) as a NR Repeater. |  |
| **Xiaomi** | It depends on the outcome of sub topic 1-1 | It depends on the outcome of sub topic 1-1 |
| **CMCC** | we need to wait for the conclusion of sub topic 1-1. | we need to wait for the conclusion of sub topic 1-1. |
| Nokia | Even if the gNB has wired/optical connection the interface can still be defined | Even if the gNB has wired/optical connection the interface can still be defined |
| **Huawei** | Same issue related to subtopic 1-1 | Same issue related to subtopic 1-1 |
| **Qualcomm** | It depends on how to define the functionality between NTN gateway and gNB. Clarifications on what’s the baseband capability would be in NTN gateway are needed. No need to define the requirements for the interface between NTN gateway and gNB. | It depends on how to define the functionality between NTN gateway and gNB. Clarifications on what’s the baseband capability would be in NTN gateway are needed. No need to define the requirements for the interface between NTN gateway and gNB. |

With respect to the Options 1 and 2, there is no clear agreement.

Some companies (4) suggested waiting for Subtopic 1-1, however Subtopic 1-1 is different ((Satellite + feeder link + NTN-Gateway) as a **single entity or not**) and no agreement was possible.

One question is if NTN could benefit or not from RAN4 NR Repeater work in Rel-17. It seems that currently it is not known how to treat **(Satellite + feeder link + NTN-Gateway)** as a NR repeater.

Moderator suggests the following proposals for the WF:

**Proposal 1-12: RAN4 shall decide if NTN can benefit or not from RAN4 NR Repeater WI in Rel-17.**

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| CATT | Agree |  |
| Ericsson | Disagree | As we propose “satellite + GW” to be considered as a Repeater, we can’t agree with this WF. |
| Intelsat | Agree |  |
| Eutelsat | Agree |  |
| Inmarsat | Agree | We cannot cover all the possible scenarios due to workload and the scenario where Satellite+ NTNGW+gNB are considered as a single 3GPP entity as far as 3GPP is concerned, and where no interface needs to be defined between NTNGW and gNB is the most likely and sensible from an effort perspective. Nothing stops a different implementation using currently-defined specifications. |
| Fraunhofer | Agree |  |
| Hughes/EchoStar | Agree |  |
| Xiaomi | Agree | We suggest to focus on service link as priority. |
| Nokia | Disagree | If requirements are defined, they should not be optional. It can be discussed if the support of a given feature is optional or not. |
| Huawei |  | We just focus on service link from standard perspective. |
| Qualcomm |  | We should focus on the service link. No need to define the RF requirements between NTN-Gateway and gNB. |

Based on the received replies, it seems that:

- 10 companies Agree with the WF.

- 2 companies Disagree with the WF.

Maybe some consensus might be reached if WF is modified. Moderator suggests the following proposal for the WF:

**Proposal 1-13: The definition of RF requirements for the linkage between NTN-Gateway and gNB should be optional. RAN4 shall focus on NTN service link from standard perspective.**

## Companies views’ collection for 1st round

### Open issues

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

**Example 1**

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

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #2: Generic Parameters

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2106545](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106545.zip) | Xiaomi | **Proposal 2: no need to define RF requirements for the linkage between NTN-Gateway and gNB** |
| [R4-2106686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106686.zip) | Huawei, HiSilicon | **Observation 1: Different implementations between NTN-Gateway and gNB can’t be excluded, such as wireless solution, RF cable and optical fiber.**  **Observation 2: Based on the outcome during the Study Phase, Uu interface was not assumed between NTN gateway and gNB.**  **Proposal 1: There is no need to define the RF requirements for the linkage between NTN-Gateway and gNB.** |
| [R4-2104808](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104808.zip) | CATT | **Observation 2: RF requirement is not possible to be specified between the components within the black box due to lack of standard interface.**  **Proposal 2: It is proposed that no RF requirement is defined for the linkage between NTN-Gateway and gNB. RAN4 should focus on defining RF requirement for service link only.**  **Proposal 3: It is proposed to only specify BS-alike requirements for NTN.** |
| [R4-2107263](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107263.zip) | THALES | **Proposal 4**: RAN4 to develop new TS capturing the radio transmission and reception requirements for the NTN-Payload.  **Proposal 6:** RAN4 can consider (when required) current gNB specifications for parameters such as REFSENS.  **Proposal 7:** Specific NTN GW parameters/requirements (e.g. NTN GW REFSENS) are implementation dependent and will be adapted according to existent gNB specification.  **Proposal 8:** If required, RAN4 can reuse in Rel-17 current gNB hypotheses for the ground gNB component in NTN, as described by the technical specification TS 38.104. |

## Open issues summary

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

### Sub-topic 2-1

*Sub-topic description:*

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

**Issue 2-1:** gNB hypotheses for the ground gNB component in NTN

* Proposals
  + Option 1: If required, RAN4 can reuse in Rel-17 current gNB hypotheses for the ground gNB component in NTN, as described by the technical specification TS 38.104.
  + Option 2: Other
* Recommended WF
  + Option 1

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| CATT | Not sure. | It depends. If we treat Satellite + feeder link + NTN Gateway + gNB as an entity, the requirements might need to be discussed. But support to have minimum impact to the current BS requirements. |
| Ericsson | Might agree? | Not sure what mean “gNB hypotheses” and “if required” here.  But we could agree that the ground gNB shall be specified following TS 38.104. |
| Intelsat | Agree |  |
| ESA | Agree |  |
| OPPO | Agree | No matter how the Satellite, feeder link, NTN Gateway and gNB in NTN system are considered, only if the gNB here transmits, the gNB requirements shall be met. |
| ZTE |  | Similar view as Ericsson. |
| Inmarsat | Agree |  |
| Fraunhofer | Agree |  |
| Hughes/EchoStar | Agree |  |
| Xiaomi |  | Similar view as Ericsson. The intention of this issue is not clear for us |
| CMCC |  | Share the similar views with CATT and Ericsson, the same RF requirements as BS TS 38.104 are suggested. If some new modification is required in future, it is suggested to emphasize these modifications are only applicable for NTN gNB not for all gNBs. |
| Nokia |  | It is not clear what this implicates. |
| Huawei |  | TS 38.104 is defined as Base Station (BS) radio transmission and reception. gNB seems a logical concept. I’m not sure gNB are same with Base station. |

7 companies seem to agree, 7 companies are not sure

Moderator clarifies that ‘gNB hypothesis’ refers to the hypothesis that should be considered for gNB connected to the GW (that is used for NTN operation purpose). Please note that is not a reference for TN gNB used for coexistence with NTN system.

Taking into account this clarification, the moderator suggests the following proposal:

**Proposal 2-1: RAN4 can reuse in Rel-17 current gNB hypotheses for the “Non-NTN infrastructure gNB functions” component in NTN, as described by the technical specification TS 38.104.**

### Sub-topic 2-2

*Sub-topic description*

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

**Issue 2-2:** NTN GW parameters/requirements

* Proposals
  + Option 1: Specific NTN GW parameters/requirements (e.g. NTN GW REFSENS) are implementation dependent and will be adapted according to existent gNB specification.

**Note 1:** RAN4 can consider (when required) current gNB specifications for parameters such as gNB REFSENS.

**Note 2:** It has been already agreed in RAN3 that NTN GW is not specified by 3GPP in Rel-17.

* + Option 2: Other
* Recommended WF
  + Option 1

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| CATT | Agree |  |
| Ericsson | Disagree | The Note 2 in option 1 is not correct, see our comments for topic 1-3, this is RAN3 decision for RAN3 aspects only. |
| Intelsat | Agree |  |
| ZTE | Disagree |  |
| Inmarsat | Agree |  |
| Fraunhofer | Agree |  |
| Hughes/EchoStar | agree |  |
| CMCC | agree |  |
| Nokia | Disagree |  |
| Huawei | Disagree | Technical analysis are needed. |

7 companies agree, 4 companies disagree.

Some technical analysis is required/asked. The moderator suggests the following proposal:

**Proposal 2-2: NTN GW parameters/requirements (e.g. NTN GW REFSENS) are implementation dependent.**

**Moderator Note:** Otherwise, it means that NTN GW will have to be specified, but we already decided in RAN3 that NTN GW is implementation dependent.

### Sub-topic 2-3

*Sub-topic description*

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

**Issue 2-3:** New TS capturing the radio transmission and reception requirements for the NTN-Payload

* Proposals
  + Option 1: New TS capturing the radio transmission and reception requirements for **the NTN-Payload**
  + Option 2: New TS capturing the radio transmission and reception requirements for **Satellite node** **Note:** RAN#91-e agreement, see Proposal NTN-2.2 of RP-210791
* Recommended WF
  + Option 1

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree |  |
| CATT |  | What does “NTN payload” exactly mean? Clarifications are needed for this term. |
| Ericsson | Disagree | Option 2 was a RAN agreement (Proposal NTN-2.2), why should we reconsider this? |
| Intelsat | Agree |  |
| OPPO | Option 2. |  |
| ZTE |  | Support to have new spec for NTN node. |
| Inmarsat | Disagree | The exact practical meaning of each option should be clarified first. |
| CMCC |  | Some clarification is needed for “NTN-payload”. What’s the difference between it and satellite node? |
| Nokia | Disagree | The proposed option is not clear. Are the intention to revert RAN agreement? |
| Huawei |  | Please clarify what is the difference between NTN-payload and Satellite node Note |

**Moderator Note:** The goal is not to decide **Option 2,** the goal if we can decide **Option 1**. “NTN-Payload” follows the definition from RAN3, and it includes both notions as HAPS and Satellite:



Suggested proposal:

**Proposal 2-3:** New TS capturing the radio transmission and reception requirements for **the NTN-Payload.**

## Companies views’ collection for 1st round

### Open issues

**Example 1**

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

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #3: FR1 Generalities

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2107193](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107193.zip) | Nokia, Nokia Shanghai Bell | **Proposal 3: Identify one existing FR1 NR band for satellite deployment for use in coexistence studies.** |
| [R4-2106607](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106607.zip) | ZTE Corporation | First of all, for S-band for NTN, it includes 2 DL bands and 1 UL bands which is much different from the legacy FDD band definition of TN system with only one DL spectrum in companion with only one UL spectrum.   * **Option 1**:to define band X including 2 DL spectrum+ 1 UL spectrum for NTN system; * **Option 2**: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including only DL spectrum; * **Option 3**: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including 1 DL spectrum+ 1 UL spectrum;   **Observation 1:**  Table 1. summary of Pros and Cons of L band definition for NTN system.   |  |  |  | | --- | --- | --- | |  | **Pros** | **Cons** | | **Option 1** | Clear band definition for NTN | UE needs to support the flexible duplex distance which might cause extra implementation complexity compared with other options.  In addition, the impact for other group like RAN1/RAN2 is not clear since this is not aligned with the existing NR frame work. | | **Option 2** | This approach is aligned with the legacy NR CA framework with FDD band+SDL band. | The whole 3 spectrum block could be fully utilized only under the CA framework, this might cause some extra RRC signalling/scheduling overhead compared with Option 1. | | **Option 3** | This approach is aligned with the legacy NR CA framework with two FDD band; | The whole 3 spectrum block could be fully utilized only under the CA framework, this might cause some extra RRC signalling/scheduling overhead compared with Option 1. |   **Proposal 1: propose channel raster as 100kHz for NTN L-band;** |

## Open issues summary

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

### Sub-topic 3-1

*Sub-topic description:* The possible band configuration for S-band (can be different from the one used for the coexistence, which might be a subset)

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

**Issue 3-1:** Possible band configuration for S-band

* Proposals
  + Option 1: 5, 10, 15, 20, 25, 30 MHz
  + Option 2: 5, 10, 15 MHz
  + Option 3: other
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | Yes | Yes |  |
| CATT | Does “configuration” here mean channel bandwidth? If yes, we support option 1.  Co-existence should consider the largest channel bandwidth of 30MHz. |  |  |
| **Ericsson** | **Yes** | **Yes** |  |
| Intelsat | Yes |  |  |
| **ESA** | **Yes** | **Yes** |  |
| **OPPO** | **Yes, but for clarification why the max CBW is limited to 30MHz? Maybe better to decide when the S band range is agreed in RAN4?** |  |  |
| **ZTE** | **YES** | **YES** |  |
| **Samsung** | **Yes** | **Yes** |  |
| **Inmarsat** | **Yes** | **Yes** |  |
| Fraunhofer | Yes | Yes |  |
| Hughes/EchoStar | Yes | yes |  |
| Xiaomi | Yes | Yes |  |
| CMCC | Yes | Yes |  |
| Nokia | Yes - Dependent on operator requests | Yes - Dependent on operator requests |  |
| Huawei | Yes |  |  |
| Qualcomm | Yes  Our understanding is the possible CBW configurations are for co-ex study. The RF requirements for CBW should be decided with the conclusion of band definition. |  |  |

**Moderator’s note:** all companies seem to agree with Option 1. Most of them also agree with Option 2.

For this reason, the moderator suggests the following proposal:

**Proposal 3-1:** For NTN S-band, RAN4 shall consider 5, 10, 15, 20, 25, 30 MHz channel BW configurations.

**Note1:** This current agreement may evolve depending on operator requests.

**Note2:** This current agreement considers the possible band configuration for S-band (and can be different from the one used for the coexistence, which might be a subset).

### Sub-topic 3-2

*Sub-topic description*

**Note:** The following remark from ZTE is not clear “First of all, for S-band for NTN, it includes 2 DL bands and 1 UL bands which is much different from the legacy FDD band definition of TN system with only one DL spectrum in companion with only one UL spectrum.”

|  |  |
| --- | --- |
| Downlink (space to earth) | 2170 - 2200 MHz & 2483.5 - 2500 MHz |
| Uplink (earth to space) | 1980 - 2010 MHz |

**Moderator note:** The previous S-band contributions were referring to the range 1980 - 2010 MHz (UL) and 2170 - 2200 MHz (DL), so the S-band range that was agreed was one UL and one DL. Please see R4-2015913 (NTN use case scenarios and architectures), R4-2015915 (Possible FR1 exemplary band for NR satellite networks), R4-2101858 (Criteria for Choosing FR1 Exemplary Band), R4-2101859 (NTN FR1 Coexistence Scenarios and Related Core Requirements), and respective WF agreements.

**RAN4#98-e 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.**

Please also see contribution R4-2107270 (On the S-band NTN coexistence scenarios and simulation parameters):



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

**Issue 3-2:** [Option not clear]Band definition/combinations for S-band

* Proposals
  + Option 1: to define band X including 2 DL spectrum+ 1 UL spectrum for NTN system
  + Option 2: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including only DL spectrum
  + Option 3: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including 1 DL spectrum+ 1 UL spectrum;
  + Option 4: 1 DL spectrum+ 1 UL spectrum in the range (1980 - 2010 MHz) and (2170 - 2200 MHz);
  + Option 5: other
* Recommended WF
  + TBA

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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | | **Comments Option 3** | | **Comments Option 4** | | | **Comments Option 5** |
| THALES |  |  | |  | | Yes | | |  |
| CATT | We prefer Option 4. Proponents for other options, please clarify why we need an addition DL of 2483.5-2500MHz? | | | | | | | | |
| **Ericsson** | **No** | **No** | | **No** | | **Yes**  only introduce 1980-2010 MHz and 2170-2200 MHz band to start with. Agree with Moderator’s note here. | | |  |
| Intelsat |  |  | |  | | Yes | | | Yes |
| **ESA** |  |  | |  | | **Yes** | | |  |
| **OPPO** |  |  | |  | | **Yes.**  Not clear where 2483.5 - 2500 MHz is coming from and how it is planned to be used. | | |  |
| **ZTE** | **NO** | **NO** | | **NO** | | **Yes** | | |  |
| **Samsung** |  |  | |  | | **Yes** | | |  |
| **Inmarsat** |  |  | |  | | **Yes** | | |  |
| Fraunhofer |  |  | |  | | Yes | | |  |
| Hughes/EchoStar |  |  | |  | | Yes | | |  |
| Xiaomi |  |  | |  | | Yes | | |  |
| CMCC | Does moderator’s note mean that RAN4 wouldn’t consider 2483.5MHz-2500MHz DL in this WID? From our point of view, compared with frequency range 1980 - 2010 MHz (UL) and 2170 - 2200 MHz (DL), 2483.5-2500MHz could contribute less adjacent channel interference between NTN and TN networks as its UL is not using S band. At the early stage, it would be much simple to only use one DL and one UL for the co-existence study. Since 1980 - 2010 MHz (UL) and 2170 - 2200 MHz (DL) are suggested for co-existence study, we are OK with this co-existence assumption. But when it comes to operating bands definition, more study is suggested. | | | | | | | | |
| Nokia | No | | No | | No | | Yes |  | |
| Huawei | **No** | | **No** | | **No** | | Yes | **No** | |
| Qualcomm |  | |  | |  | | Yes |  | |

**Moderator’s note:**

* All (15) companies seem to agree with Option 4.
* 1 company suggests to use S-band extension for DL.

For this reason, the moderator suggests the following proposal:

**Proposal 3-2:** For NTN S-band, RAN4 shall consider 1 DL spectrum + 1 UL spectrum in the range (1980 - 2010 MHz) and (2170 - 2200 MHz).

### Sub-topic 3-3

*Sub-topic description*

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

**Issue 3-3:** Channel raster for S-band

* Proposals
  + Option 1: 100kHz
  + Option 2: 15kHz
  + Option 3: other
* Recommended WF
  + TBA

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | | | **Comments Option 3** |
| THALES | No (it seems too high) |  | | | Maybe 5kHz?  We should probably consider current TN specifications for the respective frequency range. |
| CATT | Propose to do more study. | | | | |
| **Ericsson** | **May be** | **May be** | | | No need to discuss this right now, better to focus first on the main topics. |
| **OPPO** | **Not sure whether this S band is a new band or will share with existing bands like DSS, if it is then might need to consider the coexisting with them. And maybe same channel raster is better?** |  | | |  |
| **ZTE** | **Maybe** | **maybe** | | |  |
|  |  | **Potentially yes – better than 100 kHz.**  **A bit early to say** | | |  |
| **Hughes/EchoStar** |  |  | | | **To be discussed** |
|  |  |  | | |  |
| **Xiaomi** | **Maybe** | **Maybe** | | |  |
| **CMCC** | **Further study is suggested** | | | | |
| Nokia |  | |  | More study is needed | |
| Huawei |  | |  | Further study is suggested | |
| **Qualcomm** |  | |  | **Need more study** | |

**Moderator’s note:** More study seems to be needed. However, 100 kHz seems to be too much, and selection should probably also be with respect to NTN experienced Doppler. For this reason, the moderator suggests the following proposal:

**Proposal 3-3:** RAN4 shall continue discussion on NTN channel raster for S-Band.

### Sub-topic 3-4

*Sub-topic description*

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

**Issue 3-4:** Possible band configuration for L-band

* Proposals
  + Option 1: 5, 10, 15, 20, 25, 30 MHz
  + Option 2: 5, 10, 15 MHz
  + Option 3: other
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | What exactly the L band freq range is intended to be introduced in RAN4? |  |  |
| CATT | Yes. 40MHz seems also possible, at least for DL, e.g. the spectrum 1518-1559MHz. |  |  |
| **Ericsson** | **Yes** | **Yes** |  |
| **Intelsat** | **Agree** |  |  |
| **OPPO** | **For clarification, what exactly the L band freq range is intended to be introduced in RAN4?** |  |  |
| **ZTE** | **Yes** | **Yes** |  |
| **OPPO** | **Yes** | **Yes** |  |
| **CMCC** | **Yes** | **Yes** |  |
| Nokia | Yes - Dependent on operator requests | Yes - Dependent on operator requests |  |
| **Huawei** | **Yes** | **Yes** |  |
| **Qualcomm** |  |  | **Need to figure out what’s the band frequency range for L-band first.** |

**Moderator Note:** Clarification is required with respect to L-band frequency range intended to be introduced in RAN4 for NTN.

**Proposal 3-4:** RAN4 shall continue discussion to clarify L-band frequency range for NTN operation.

### Sub-topic 3-5

*Sub-topic description*

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

**Issue 3-5:** Band definition/combinations for L-band

* Proposals
  + Option 1: to define band X including 2 DL spectrum+ 1 UL spectrum for NTN system
  + Option 2: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including only DL spectrum
  + Option 3: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including 1 DL spectrum+ 1 UL spectrum;
  + Option 4: other
* Recommended WF
  + TBA

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** | **Comments Option 4** |
| CATT | A little complex. Need more study. | | | |
| Ericsson | **No** | No | No | Yes  we should only start with 1 band with one contiguous frequency range for UL and one for DL. |
| **ZTE** |  |  |  | **Yes** |
| **CMCC** | **Only one UL and DL for co-existence study to simplify the workload. But when it comes to define operating bands, more study is suggested.** | | | |
| Nokia |  |  |  | Yes – but perhaps L-band definition can wait until S-band work have progressed further. |
| **Qualcomm** |  |  |  | **Need to figure out what’s the band frequency range for L-band first.** |
|  |  |  |  |  |
|  |  |  |  |  |

**Moderator Note:** RAN4 shall continue discussion to clarify L-band frequency range for NTN operation. Please see proposal 3-4.

No further suggested proposal on this topic.

### Sub-topic 3-6

*Sub-topic description*

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

**Issue 3-6:** Channel raster for L-band

* Proposals
  + Option 1: 100kHz
  + Option 2: 15kHz
  + Option 3: Other
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| CATT | Need more study. | | |
| **Ericsson** | **May be** | **May be** | No need to discuss this right now, better to focus first on the main topics. |
| **ZTE** | **May be** | **May be** |  |
| **Inmarsat** | **Potentially, but lower might be more useful.**  **A bit early to say** | **Potentially yes – better than 100 kHz.**  **A bit early to say** |  |
| Nokia |  |  | More study is needed |
| **Huawei** | **It can be aligned with S band** | | |
| **Qualcomm** |  |  | **Need more study** |
|  |  |  |  |

**Moderator Note:** RAN4 shall continue discussion to clarify L-band frequency range for NTN operation. Please see proposal 3-4.

No further suggested proposal on this topic.

### Sub-topic 3-7

*Sub-topic description*

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

**Issue 3-7:** De-scope NTN-NTN scenarios

* Proposals
  + Option 1: **De-scope NTN-NTN scenarios for satellite** in Rel-17

**Note 1:** Satellite operators occupy the same or partly overlapping frequency ranges, but different orbital slots or orbital trajectories.

**Note 2:** Satellite (NTN-NTN) operation principles are different from TN-TN.

**Note 3:** There are different co-existence mechanisms between GSO and NGSO, but the overarching principle remains the same.

* + Option 2: **Do not de-scope NTN-NTN scenarios for satellite** in Rel-17
* Recommended WF
  + Option 1

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree, agree partially, disagree** | **Comments** |
| THALES | Agree | Agree with de-scoping NTN-NTN scenarios for satellite in Rel-17 |
| CATT |  | OK to discuss. |
| Ericsson | Disagree | This is also coexistence simulation discussion…  More inputs on the mentioned co-existence mechanisms would be needed to understand this proposed option 1. |
| Intelsat | Agree | Agree with Thales |
| ESA | Agree | Option 1. |
| OPPO | FFS | Need more study on the notes provided in Option 1 and better understanding on the coexistence situations. |
| ZTE |  | It could be discussed in NTN coexistence study. |
| Samsung | Agree with comment | If co-channel is a normal case among different satellite systems operation, the coexistence study btw NTN and NTN can be de-scoped. Additional clarification on satellite operation principle as well as co-channel interference mitigation mechanism are required. |
| Fraunhofer | Agree | Option 1 |
| Hughes/EchoStar | Agree | Option1 |
| Nokia | Disagree | NTN-NTN service link co-existence should be studied. |
| Huawei |  | Why don’t we discuss this issue in co-existence thread? |
| Qualcomm | Disagree | Does it mean in any case it would be no NTN to NTN co-ex scenario deployed in the adjacent channel? |

Summary of discussion:

* 6 companies Agree with the WF to descope NTN-NTN scenarios from coexistence studies in adjacent band.
* 3 companies Disagree

**Moderator Note1:** **More inputs are required from the operators.**

**Moderator Note2:** **At least for S-band, RAN4 should not consider NTN-NTN** intra-operator channel coexistence in adjacent bands. For inter-operator some ITU-R rules might apply. For this reason, these scenarios could be deprioritized.

**Proposal 3-5:** RAN4 shall consider inputs from NTN operators for the NTN-NTN coexistence scenarios for MSS S-band.

### Sub-topic 3-8

*Sub-topic description*

Nokia wrote “Identify one existing FR1 NR band for satellite deployment for use in coexistence studies.”, however comment is not clear. Please see RAN4#98e decisions:

**RAN4#98-e 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.**
* **NTN UE parameters**
  + **Handheld UEs for FR1.**
* **TN UE parameters**
  + **The existing RF requirements (i.e. ACS and ACLR for both BS and UE) of TN in the spec (i.e. TS 38.104 and 38.101) shall be reused when doing the coexistence study between NTN and TN.**

Question from the moderator: Do you mean this proposal is for existent FR1 NR band different from MSS S-band?



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

**Issue 3-8:** [option not clear] Identify one existing FR1 NR band for satellite deployment for use in coexistence studies

* Proposals
  + Option 1: **Identify one existing FR1 NR band** for satellite deployment for use in coexistence studies

**Note:** Exemplary FR1 NR bands (S-band and L-band) for satellite deployments have been already selected in RAN4#98e. However, only S-band will be used for coexistence studies with TN.

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

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | **Yes (Other).** What is the purpose of identifying now another “existing” FR1 NR band? Is this MSS? |
| CATT |  | We already agreed that “Using S-band frequency range i.e. 2GHz for co-existence simulation in FR1” |
| **Ericsson** | **No** | **Yes**  Agree with Moderator’s note, this is very unclear as it was already agreed to do the coexistence studies with 2 GHz. |
| Intelsat |  | An exemplary S-band was already agreed. Is this in addition? |
| **OPPO** | **Maybe this means the existing RAN4 bands like n1, etc. rather than “S band” which is not 3GPP spec wording.** |  |
| **ZTE** |  | **It has been agreed in the last RAN4 meeting.** |
| **Inmarsat** |  | **It seems it was already agreed?** |
| **Fraunhofer** |  | **Agree with Thales** |
| **Hughes/EchoStar** |  | **RAN 4 already identified “S Band”** |
| **Xiaomi** |  | **It has been agreed in the last meeting.** |
| **CMCC** |  | **I guess we already have the agreement that we only use S band for coexistence study to reduce simulation workload.** |
| Nokia | It seems our contribution have not been read well. Our intention is to select an already defined band which can be repurposed or used as reference for satellite deployment simulations. S-band does not exist as a NR band. |  |
| **Huawei** |  | **We have made the agreement on 2GHz.** |
| **Qualcomm** |  | **Existing NR band is not for MSS band** |

**Moderator note:** it seems that MSS S-band can be considered as part of n1/n65, so it exists as NR band. However, existing NR band is not for MSS band. Is the intention to extend the considered frequency range for NTN operation?

We could try for 2nd round a proposal as follows:

**Proposal 3-6:** RAN4 to select an already defined NR band, which can be repurposed or used as reference for satellite deployment simulations.

## Companies views’ collection for 1st round

### Open issues

**Example 1**

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

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #4: FR2 Generalities

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2107217](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107217.zip) | Hughes/EchoStar, Inmarsat, Thales, ESA, Intelsat | RP-210439 provided much useful information with respect to potential simulation parameters, deployment scenarios for **broadband satellite communications**, and coexistence in adjacent bands.  cid:image012.png@01D71715.911937A0  However, RAN4 should be also aware that **the estimated current workload for proposed Ka-band coexistence scenarios is at least 5 times lower than current exemplary S-band coexistence scenarios**, for several reasons that will be further addressed in this paper.  cid:image010.png@01D71744.932A31F0  **Observation 1:** For S-band there are currently at least **58 scenarios** to be considered for simulations required for coexistence studies in adjacent bands.  **Observation 14:** For Ka-band the best case is with only **6 scenarios** to be considered for coexistence in adjacent bands.  **Observation 15:** For Ka-band the worst case is with only **12 scenarios** to be considered for coexistence in adjacent bands.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Combination | **Aggressor** | **Victim** | Comment | Number of scenarios | | TN with NTN | TN DL | NTN UL | TN in TDD, scenario also considered in FR1 | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | TN with NTN | NTN UL | TN DL | TN in TDD, scenario also considered in FR1 | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | TN with NTN | NTN UL | TN UL | TN in TDD, scenario not considered in FR1. | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | **Total number of scenarios Ka-band** |  | |  | **Best case: 6**  **Worst case: 12** |   **TN-NTN coexistence scenarios in adjacent bands for Ka-band**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **No.** | **Frq.** | **TN** | **TN scenario** | **NTN** | | **1** | 27 GHz-30 GHz | NR | Dense urban | GEO | | **2** | 27 GHz-30 GHz | NR | Dense urban | LEO 600km | | **3** | 27 GHz-30 GHz | NR | Urban macro | GEO | | **4** | 27 GHz-30 GHz | NR | Urban macro | LEO 600km |   **Observation 16:** Currently there are at least 58 types of coexistence scenarios for S-band, while for Ka-band there are only 6 (best case) and 12 (worst case). **Therefore, we estimate the Ka-band required simulations for coexistence scenarios in adjacent bands between 1/10 and 1/5 as compared with S-band.** |
| [R4-2107193](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107193.zip) | Nokia, Nokia Shanghai Bell | **Observation 5: It is not clear if any currently used satellite bands (e.g. Ka band) can be covered by the FR2 range, or not.**  **Observation 6: There are no FDD bands include in the FR2 specification and therefor no requrements for FR2 FDD bands already defined in the specification.**  **Proposal 4: Postpone NTN coexistence studies for a NR FR2 band until requrements for FDD bands in the FR2 range have been included to specification.** |
| [R4-2106897](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106897.zip) | Ericsson | **Observation 1: ITU-R allowed ESIM to use the FSS spectrum only in frequency range 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space).**  **Observation 2: Specific regulatory and technical conditions have been defined to allow ESIM in ITU-R to use those bands, see WRC Resolutions 156, 169 and 173.**  **Observation 3: Only ESIM under certain conditions could use FSS spectrum and only in 17.7-20.2GHz and 27.5-30.0GHz.**  **Proposal 1: The frequency ranges considered for NTN shall only be spectrum allocated by ITU to *Mobile satellite* as primary service. The 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space) frequency ranges which might also be considered for NTN band but as a specific band reserved for ESIM type of application.**  **Observation 4: Discussion on Ka-band as a NTN band under ESIM conditions are deferred until after March 2022.**  **Proposal 2: No NTN band will be specified in FR2 in Rel-17.** |

## Open issues summary

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

### Sub-topic 4-1

*Sub-topic description:*

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

**Issue 4-1:** Consider Ka band for coexistence simulations

* Proposals
  + Option 1: **Consider** UL Ka band for NTN-TN coexistence simulations in Rel-17

**Note1:** number of coexistence scenarios is much lower than the ones from S-band (FR1);

**Note2:** please note that at least 5 companies proposed this option;



**Note3:** the estimated current workload for proposed Ka-band coexistence scenarios is at least 5 times lower than current exemplary S-band coexistence scenarios.

* + Option 2: **Need further discussion and refinement on** UL Ka band for NTN-TN coexistence simulations in Rel-17
  + Option 3: **Postpone discussion** on FR2/Ka band **until after Rel-17.**
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | Yes, preference for this option. |  |  |
| **CATT** | **Positive for Ka band. Main concern is workload.** | | |
| **Ericsson** | **No** | **No** | **Yes**  This was already agreed in last RAN91-e meeting, mainly because of the extra workload needed on 7-24GHz. |
| Intelsat | Yes, Option 1 is reasonable. |  |  |
| **OPPO** |  |  | **Yes** |
| **ZTE** |  |  | **It depend on workload and other TN band definition.** |
| **Inmarsat** | **Yes** |  |  |
| **Fraunhofer** | **Yes** |  |  |
| **Hughes/EchoStar** | **Yes, prefer this option** |  |  |
| Panasonic | **Yes, we prefer this option.** |  |  |
| Xiaomi |  |  | **Depends on workload** |
| Nokia |  |  | Given the remaining work in this WI this would be an reasonable approach. |
| Huawei | **No** | **No** | **Yes**  **We can follow the agreement in last RAN91.** |

Summary of the discussion:

* 7 companies prefer Option 1;
* 4 companies prefer Option 3;
* 2 companies have expressed concerns with the remaining workload.

**Moderator note:** No clear agreement reached. However, the discussion was for “coexistence simulations”. Propose to continue discussion in next meeting depending on the S-band workload/advancement.

**Proposal 4-1**: RAN4 may continue Ka/FR2 NTN coexistence discussion in next RAN4 meetings depending on the NTN S-band coexistence simulations advancements.

### Sub-topic 4-2

*Sub-topic description*

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

**Issue 4-2:** Consider Ka band as exemplary band

* Proposals
  + Option 1: **Consider Ka band** as NTN exemplary band for **satellite broadband communications** in Rel-17

**Note1:** please note that at least 5 companies proposed this option;

**Note2:** please note that only 2 companies proposed to postpone;

* + Option 2: **Need further discussion to consider Ka band** as NTN exemplary band for **satellite** **broadband communications** in Rel-17
  + Option 3: **Postpone discussion** on FR2/Ka band **until after Rel-17.**
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Comments Option 3** |
| THALES | **Satellite broadband communication** is an important market and should be considered in Rel-17.  However, the work on this scenario may start after sufficient progress on S-band (FR1) has been carried out.  Moreover, in line with RAN decision, we recommend to start **“RAN4 to identify further technical issues, associated to the deployment of NTN supported by NR (FDD mode) in the satellite Ka band.”** (Agreed Proposal NTN-1.3 from RP-210791) |  |  |
| **Ericsson** | **No** | **No** | **Yes**  This was already agreed in last RAN91-e meeting, mainly because of the extra workload needed on 7-24GHz. |
| Intelsat | Agree with Thales |  |  |
| **OPPO** |  |  | **Yes** |
| **Inmarsat** | Agree with Thales. Ericsson interpretation of RAN 91-e seems arbitrary. |  |  |
| **Fraunhofer** | **Agree with Thales** |  |  |
| **Hughes/EchoStar** | **Agree with Thales** |  |  |
| Panasonic | **Yes, we agree with Thales and prefer this option.** |  |  |
| Nokia |  |  | Given the remaining work in this WI this would be an reasonable approach. |
| Huawei | **No** | **No** | **Yes**  **We can follow the agreement in last RAN91.** |
| Qualcomm |  | **We should focus on FR1 at this stage anyway.** |  |

Summary of the discussion:

* 6 companies prefer Option 1;
* 3 companies prefer Option 2;
* 4 companies prefer Option 3.

**Moderator note1:** No clear agreement reached. Discussion can continue, and we should probably focus on FR1 at this stage. Depending on NTN S-band studies, introduction of **exemplary Ka band** in Rel-17 can be further considered.

**Moderator note2:** No proposed agreement, however **satellite broadband communications** is very important in Rel-17, and many NTN operators already showed interest.

### Sub-topic 4-3

*Sub-topic description: Allocated spectrum type for NTN*

**Issue 4-3:** Allocated spectrum type for NTN

* Proposals
  + Option 1: The frequency ranges considered for NTN shall only be spectrum allocated by ITU to *Mobile satellite* as primary service. The 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space) frequency ranges which might also be considered for NTN band but as a specific band reserved for ESIM type of application.
  + Option 2: The frequency ranges to be considered for NTN above 10 GHz refer to spectrum allocated by ITU to satellite services in which VSAT and ESIM terminals can operate. In particular, it includes the Satellite Ka band that refers to [17.3 – 20.2 GHz] on the downlink and [27.0 – 30.0 GHz] on the uplink.
* Recommended WF
  + TBA

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES |  | Yes, preference for this option which is in line with RAN-P decisions in RP-210791:  **-Agreed Proposal NTN-1.1: “For frequencies above 10 GHz, any work can be limited to VSAT, ESIM service and terminals.”**  **-Agreed Proposal NTN-1.2: “The Satellite Ka band refers to [17.3 – 20.2 GHz] on the downlink and [27.0 – 30.0 GHz] on the uplink as allocated by ITU-R to satellite services.** **Some of this range is designated as FSS and some as MSS.”** |
| Ericsson | Yes,  There should be some misunderstanding here. This proposal is compliant with ITU-R RR, no less, no more…  Note this proposal is also aligned with RAN decision and proposals NTN-1.1 and NTN-1.2. | No  Again, there should be some misunderstanding: this statement would overrule ITU-R RR by allowing any FSS spectrum above 10GHz for ESIM, which can’t be acceptable.  We could agree to consider any FSS spectrum that ITU-R RR allowed for ESIM, but not FSS spectrum that ITU-R has not allowed for ESIM. |
| Intelsat |  | Yes, our preference is Option 2 - Frequency ranges above 10 GHz in spectrum allocated by the ITU to satellite services in which VSAT and ESIM terminals can operate.  It is noted that operation of earth stations in motion are not limited in the RRs to Ka-band, for example ITU RESOLUTION 902 (WRC-03) allows earth station on vessels to operate in the 5925-6425 GHz and 14-14.5 GHz band.  **RE: Ericsson we don’t see a reason to limit this.** |
| **ESA** |  | **YES. The Ericsson statement is not correct. We strongly suggest to read carefully the ITU-R recommendations. For the sake of clarity, please consider this link:**  **<https://www.itu.int/en/mediacentre/backgrounders/Pages/Earth-stations-in-motion-satellite-issues.aspx>**  **From there, the ITU statement is: “*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. … Delegates from around the world agreed at the WRC-19 in Sharm el-Sheikh, Egypt to a new Resolution that will boost the deployment of ESIM.***  ***To address the increasing need for radio-frequency spectrum for ESIM, while protecting other services, delegates at WRC-19 decided on the regulatory and technical conditions under which the frequency bands 17.7‑19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) can be used by the three types of ESIM communicating with geostationary (GSO) space stations in the fixed-satellite service (FSS)*”** |
| **Inmarsat** | **No** | **Yes**  It has been clarified throughout the SI and WI definition that NTN work would cover both VSAT and ESIMs/ESOMPs (which are a type of mobile VSATs operating in FSS spectrum). Hence the frequency bands considered for 3GPP NTN RAN4 work should encompass them.  Furthermore, we agree with Intelsat’s and Thales comments, there seems to be either a misunderstanding or an arbitrary interpretation of the ITU-R RRs. ESIM allocations exist both in and also outside of Ka band. There is no reason to restrict it and this is what the proposal aims to capture, in complement with the other agreed proposals highlighted by Thales.   It is not up to 3GPP to decide in which frequencies which UEs are allowed to operate because 3GPP doesn’t decide spectrum regulations, and this is something that is left to ITU-R to regulate. And the Option 2 proposal aims to capture exactly that.  It is well understood that, in operation and deployment, the operators will have to respect the specific ITU-R allocations and regional regulations depending on the service and usage of the UEs. This is normal and is also true for terrestrial deployments, but has nothing to do with 3GPP specification and frankly it is not appropriate for 3GPP to question ITU-R decisions. |
| **Fraunhofer** |  | **Yes** |
| **Hughes/EchoStar** |  | **Yes, agree with Thales and ESA** |
| Panasonic |  | **Yes, we agree with Thales and prefer this option.** |
| Nokia | Yes |  |
| Huawei | **We can postpone discussion on FR2/Ka band after Rel-17 based on RAN plenary’s agreement.** | |

Discussion summary:

* 7 companies agreed with Option 2;
* 2 companies agreed with Option 1;
* 1 company suggested to postpone discussion;

**Moderator note1:** It seems that there is an important disagreement on Ka ITU-R definition and operational purpose.

**Moderator note2:** Companies are further encouraged to verify the provided references.

**Moderator note3:** No agreement possible in RAN4. For the time being RAN4 may use RAN-P decisions in RP-210791:

-Agreed Proposal NTN-1.1: “For frequencies above 10 GHz, any work can be limited to VSAT, ESIM service and terminals.”

-Agreed Proposal NTN-1.2: “The Satellite Ka band refers to [17.3 – 20.2 GHz] on the downlink and [27.0 – 30.0 GHz] on the uplink as allocated by ITU-R to satellite services. Some of this range is designated as FSS and some as MSS.”

## Companies views’ collection for 1st round

### Open issues

**Example 1**

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

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #5: HAPS Aspects

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2107193](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107193.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: ITU separates spectrum for satellite and HAPS deployments in separate groups.**  **Observation 2: HAPS are already deployed in the LTE spectrum it should be natural also to support these deployments in NR spectrum.**  **Proposal 1: Identify one existing FR1 NR band for HAPS deployment for use in coexistence studies.**  **Proposal 2: Use NR band n1 as example band for HAPS related coexistence studies.** |

## Open issues summary

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

### Sub-topic 5-1

*Sub-topic description:*

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

**Issue 5-1:** FR1 NR band for HAPS deployment for use in coexistence studies

* Proposals
  + Option 1: **Identify one existing FR1 NR band for HAPS deployment** for use in coexistence studies.
  + Option 2: Other
* Recommended WF
  + TBA

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| CATT | Ok |  |
| Ericsson | No | It was already agreed to use 2GHz for coex studies… |
| Intelsat | **Yes** |  |
| **OPPO** | **Ok** |  |
| **ZTE** | **Okay, following questions is whether it’s co-channel or adjacent channel.** |  |
| **Xiaomi** | **Yes** |  |
| Nokia | Yes |  |
| **Huawei** | No | It was already agreed to use 2GHz for coex studies… |
| **Qualcomm** | **Yes** |  |

Summary of discussions:

* 7 companies agree
* 2 companies disagree

**Received questions:** What NR band should be considered when referring to HAPS @ 2 GHz? Channel or co-channel coexistence?

**Proposal 5-1:** RAN4 shall further refine **FR1 NR band description for HAPS deployment at @2GHz** for use in coexistence studies.

### Sub-topic 5-2

*Sub-topic description*

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

**Issue 5-2:** NR band n1 as example band for HAPS related coexistence studies

* Proposals
  + Option 1: NR band n1 **as example band** for HAPS related coexistence studies
  + Option 2: NR band n1 **as exemplary band** for HAPS related coexistence studies

**Note:** “Exemplary” as for “Exemplary” NTN FR1 and FR2.

* + Option 3: Other
* Recommended WF
  + TBA

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** | **Option 3** |
| CATT | What’s the difference between option 1 and option 2? | |  |
| Ericsson | NA | NA | It was already agreed to use 2GHz for coex studies… |
| Intelsat |  | **Yes** |  |
| **OPPO** | **Ok** | **Ok** |  |
| Nokia | Yes |  |  |
| **Huawei** | **OK** | **OK** |  |
| **SoftBank** | **Yes** We would like to know the difference between Option 1 and 2, same as CATT |  |  |
| **Qualcomm** | **Yes** |  |  |

Summary of discussions:

* 5 companies agree
* 3 companies disagree

**Clarifications:**

* “Exemplary” means to be specifically used (in a first stage) for a given deployment, by taking into account specific coexistence scenarios. For Satellite 5G NR operation, 2 MSS bands (already used by satellite operation) have been selected as “exemplary” bands.
* “Example” means not necessary with any specific design and dedicated to a specific operation. It may use existent NR bands, if no identified specific bands. Coexistence scenarios should be clearly identified with respect to selected band.

It is true that coexistence simulations at 2GHz for HAPS is not clear without considering any kind of NR band. The moderator suggests:

**Proposal 5-2:** NR band n1 **as example band** for HAPS related coexistence studies **at 2GHz.**

### Sub-topic 5-3

*Sub-topic description*

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

**Issue 5-3:** Separate HAPS (NTN-TN and/or NTN-NTN) coexistence scenarios from Satellite (NTN-TN and/or NTN-NTN) coexistence scenarios

* Proposals
  + Option 1: Separate HAPS coexistence scenarios from Satellite coexistence scenarios

**Note:** the two NTN systems may consider different bands, different simulation parameters, and/or different specifications

* + Option 2: Do not separate HAPS coexistence scenarios from Satellite coexistence scenarios
* Recommended WF
  + TBA

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

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments Option 1** | **Comments Option 2** |
| THALES | Yes. It might be good to separate scenarios and bands (potentially in two different specifications) because parameters are different. |  |
| Ericsson | Yes, it could make sense even if we have still to consider NTN and HAPS coexistence scenarios… |  |
| Intelsat | Yes |  |
| **OPPO** | **Yes** |  |
| **ZTE** | **Yes, it was agreed in last RNA meeting.** |  |
| **Xiaomi** | **Yes** |  |
| Nokia | Yes |  |
| **Huawei** | **Yes** |  |
| **Qualcomm** | **Yes** |  |

All companies agree with the Option 1. Therefore, the moderator proposes for agreement:

**Proposal 5-3:** Separate HAPS coexistence scenarios from Satellite coexistence scenarios

**Note:** the two NTN systems may consider different bands, different simulation parameters, and/or different specifications

## Companies views’ collection for 1st round

### Open issues

**Example 1**

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

**Example 2**

Sub topic 1-1

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

Sub topic 1-2

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

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Updated Work Plan

## Companies’ contributions summary

Please see current work plan reflected in **R4-2104879 (revision of R4-2017661**). Companies are invited to provide their feedback, if any.

## Open issues summary

Current Work Plan for current RAN4 RF and next RAN4 meetings:

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

* Further discuss coexistence study scenarios to be considered and related simulations assumptions.
* Agree remaining details on the NTN architecture and NTN components description
* Prepare RAN1 LS reply on Doppler estimation and error

**May 2021, RAN4#99, e-meeting**

* Agree on coexistence study scenarios to be considered and related simulations assumptions.
* Early discussion on the calibration of simulations for coexistence study scenarios.
* Start discussion on demodulation performance.

**August 2021, RAN4#100, Toulouse**

* Calibration of simulations for coexistence study scenarios and Initial discussion on simulation results for coexistence study scenarios.
* Further discussion on the RF core requirements (UE and “BS” requirements) for NTN
* Further discuss on exemplary band(s) specific requirements
* Continue discussion on demodulation performance; align on needed requirements and simulation assumptions.

**November 2021, RAN4#101, TBD**

* Further discussion on simulation results for coexistence study scenarios.
* Further discussion on the RF core requirements (UE and “BS” requirements) for NTN
* Further discuss on exemplary band(s) specific requirements
* Continue discussion on demodulation performance and early simulation results; finalize the list of needed requirements and simulation assumptions.
* Start discussion on RF conformance testing.

**February 2022, RAN4#102, TBD**

* Align on simulation results for coexistence study scenarios.
* Further discuss on the RF core requirements (UE and “BS” requirements) for NTN
* Further discuss on exemplary band(s) specific requirements
* Continue discussion on demodulation performance and align on simulation results.
* Further discuss RF conformance testing.
* Start drafting of CRs.

**April 2022, RAN4#103, TBD**

* Further discussion on the RF core requirements (UE and “BS” requirements) for NTN
* Further discussion on exemplary band(s) specific requirements
* Align on demodulation requirements.
* Further discuss RF conformance testing.
* Further drafting of CRs

**May 2022, RAN4#103-bis, TBD**

* Further discussion on the RF core requirements (UE and “BS” requirements) for NTN
* Further discussion on exemplary band(s) specific requirements
* Align on demodulation requirements.
* Further discuss RF conformance testing.
* Further drafting of CRs

**August 2022, RAN4#104, TBD**

* Agree on the RF core requirements (UE and “BS” requirements) for NTN
* Agree on exemplary band(s) specific requirements
* Finalize demodulation requirements.
* Finalize RF conformance testing.
* Endorse CRs

## Companies views’ collection for 1st round

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree/Agree with Changes** | **Work Plan update recommendation** |
| THALES | Agree |  |
| Ericsson |  | As commented in previous meeting, this WP looks very aggressive considering this complex WI, but it’s good input to guide our work. |
| Hughes/EchoStar | Agree |  |
| Nokia |  | We can use this as guideline but do think it is too optimistic. |

## Summary for 1st round

## Discussion on 2nd round (if applicable)

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

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

Notes:

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

## 2nd round

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

Notes:

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

# Appendix: Companies contribution summary

Contribution summaries are as follows:

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2104879](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104879.zip) | THALES | **NR\_NTN\_solutions work plan (RF & RRM)**  An updated work plan for the Rel-17 NR-NTN work item is proposed for RAN4. |
| [R4-2107217](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107217.zip) | Hughes/EchoStar, Inmarsat, Thales, ESA, Intelsat | RP-210439 provided much useful information with respect to potential simulation parameters, deployment scenarios for **broadband satellite communications**, and coexistence in adjacent bands.  cid:image012.png@01D71715.911937A0  However, RAN4 should be also aware that **the estimated current workload for proposed Ka-band coexistence scenarios is at least 5 times lower than current exemplary S-band coexistence scenarios**, for several reasons that will be further addressed in this paper.  cid:image010.png@01D71744.932A31F0  **Observation 1:** For S-band there are currently at least **58 scenarios** to be considered for simulations required for coexistence studies in adjacent bands.  **Observation 14:** For Ka-band the best case is with only **6 scenarios** to be considered for coexistence in adjacent bands.  **Observation 15:** For Ka-band the worst case is with only **12 scenarios** to be considered for coexistence in adjacent bands.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Combination | **Aggressor** | **Victim** | Comment | Number of scenarios | | TN with NTN | TN DL | NTN UL | TN in TDD, scenario also considered in FR1 | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | TN with NTN | NTN UL | TN DL | TN in TDD, scenario also considered in FR1 | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | TN with NTN | NTN UL | TN UL | TN in TDD, scenario not considered in FR1. | At least 4 (since no HAPS and no LEO@1200) but can be reduced to 2 (if only GEO) | | **Total number of scenarios Ka-band** |  | |  | **Best case: 6**  **Worst case: 12** |   **TN-NTN coexistence scenarios in adjacent bands for Ka-band**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **No.** | **Frq.** | **TN** | **TN scenario** | **NTN** | | **1** | 27 GHz-30 GHz | NR | Dense urban | GEO | | **2** | 27 GHz-30 GHz | NR | Dense urban | LEO 600km | | **3** | 27 GHz-30 GHz | NR | Urban macro | GEO | | **4** | 27 GHz-30 GHz | NR | Urban macro | LEO 600km |   **Observation 16:** Currently there are at least 58 types of coexistence scenarios for S-band, while for Ka-band there are only 6 (best case) and 12 (worst case). **Therefore, we estimate the Ka-band required simulations for coexistence scenarios in adjacent bands between 1/10 and 1/5 as compared with S-band.** |
| [R4-2107193](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107193.zip) | Nokia, Nokia Shanghai Bell | **Observation 1: ITU separates spectrum for satellite and HAPS deployments in separate groups.**  **Observation 2: HAPS are already deployed in the LTE spectrum it should be natural also to support these deployments in NR spectrum.**  **Proposal 1: Identify one existing FR1 NR band for HAPS deployment for use in coexistence studies.**  **Proposal 2: Use NR band n1 as example band for HAPS related coexistence studies.**  **Proposal 3: Identify one existing FR1 NR band for satellite deployment for use in coexistence studies.**  **Observation 4: The RF requirements for the service link provided by LEO and GEO deployments should be at least same level as those for a terrestrial gNB.**  **Observation 5: It is not clear if any currently used satellite bands (e.g. Ka band) can be covered by the FR2 range, or not.**  **Observation 6: There are no FDD bands include in the FR2 specification and therefor no requrements for FR2 FDD bands already defined in the specification.**  **Proposal 4: Postpone NTN coexistence studies for a NR FR2 band until requrements for FDD bands in the FR2 range have been included to specification.** |
| [R4-2106607](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106607.zip) | ZTE Corporation | * **Option 1**:to define band X including 2 DL spectrum+ 1 UL spectrum for NTN system; * **Option 2**: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including only DL spectrum; * **Option 3**: to define band X including 1 DL spectrum+ 1 UL spectrum and band Y including 1 DL spectrum+ 1 UL spectrum;   **Observation 1:**  Table 1. summary of Pros and Cons of L band definition for NTN system.   |  |  |  | | --- | --- | --- | |  | **Pros** | **Cons** | | **Option 1** | Clear band definition for NTN | UE needs to support the flexible duplex distance which might cause extra implementation complexity compared with other options.  In addition, the impact for other group like RAN1/RAN2 is not clear since this is not aligned with the existing NR frame work. | | **Option 2** | This approach is aligned with the legacy NR CA framework with FDD band+SDL band. | The whole 3 spectrum block could be fully utilized only under the CA framework, this might cause some extra RRC signalling/scheduling overhead compared with Option 1. | | **Option 3** | This approach is aligned with the legacy NR CA framework with two FDD band; | The whole 3 spectrum block could be fully utilized only under the CA framework, this might cause some extra RRC signalling/scheduling overhead compared with Option 1. |   **Proposal 1: propose channel raster as 100kHz for NTN L-band;** |
| [R4-2106899](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106899.zip) | Ericsson | In this contribution, a brief overview of NTN system reference model and reference points was discussed, and a reference model based on handling of “gateway + satellite” as repeater was proposed.    Figure 4 NTN overview architecture and gNB and UE reference points  The approach is simply to treat Gateway + satellite as a repeater which would allow for proper co-existence studies needed for compatibility but also not posing any restriction on any functional/performance split between gateway and satellite. In addition, this approach would eliminate the dependencies between gateway/satellite and gNB or UE.  **Observation1: Test set ups and procedure shall be clearly described in conformance specifications. Keeping GTW+satellite as a separate repeater node would help doing this.**  **Proposal 1: RAN4 should handle gateway + satellite as a repeater and specify needed requirements for gateway + satellite in a new NTN repeater specification.** |
| [R4-2106608](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106608.zip) | ZTE Corporation | **Observation 1: if NTN gateway is cable connected with gNB, then satellite+feeder link+ NTN-gateway would work similar as legacy RRU.**  **Observation 2: if NTN gateway without baseband capability is wireless connected with gNB, then satellite+feeder link+ NTN-gateway would work as simple repeater;**  **Observation 3: if NTN gateway with baseband capability is wireless connected with gNB, then satellite+feeder link+ NTN-gateway would work as relay;**  **Proposal: consider the following diagram to define requirements for NTN network requirements.** |
| [R4-2106545](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106545.zip) | Xiaomi | Option 1  Option 2  Figure 1, two candidate options  Based on the discussion on RF interfaces for NR NTN, we give the following proposals:  **Proposal 1: it is preferred to consider Satellite + feeder link + NTN-Gateway + gNB as a single entity (option 2)**  **Proposal 2: no need to define RF requirements for the linkage between NTN-Gateway and gNB** |
| [R4-2106686](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106686.zip) | Huawei, HiSilicon | Referring to clause 5.1 from TR 38.821, the detailed description about transparent satellite architecture can be found. The corresponding Use plane and Control plane Protocol stack are shown below.    Figure 5 User plane Protocol stack (Transparent satellite)    Figure 6 Control plane Protocol stack (Transparent satellite)  It can be found that the Uu interface was not assumed between NTN gateway and gNB.  Based on the discussion, all the observations and proposals are listed below:  **Observation 1: Different implementations between NTN-Gateway and gNB can’t be excluded, such as wireless solution, RF cable and optical fiber.**  **Observation 2: Based on the outcome during the Study Phase, Uu interface was not assumed between NTN gateway and gNB.**  **Proposal 1: There is no need to define the RF requirements for the linkage between NTN-Gateway and gNB.**  **Proposal 2: RAN4 can consider (Satellite + feeder link + NTN-Gateway + gNB) as a single entity.** |
| [R4-2104808](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2104808.zip) | CATT | In last RAN3 meeting, the following networking-RAN architecture has been included in 38.300 for NTN. It is apparent that Satellite + feeder link + NTN-Gateway + gNB as a single entity is treated as single entity. This entity is seen as a black box without any interface standardized between the components.    Figure 1: Networking-RAN architecture with transparent satellite  This contribution further discussed the NTN architecture and its impact on RF requirements. The following observations and proposals are concluded.  **Observation: Satellite + feeder link + NTN-Gateway + gNB is treated as a single entity, which means Option 2 in [1] is correct understanding.**  **Proposal 1: Treat Satellite + feeder link + NTN-Gateway + gNB as a single entity (black box).**  **Observation 2: RF requirement is not possible to be specified between the components within the black box due to lack of standard interface.**  **Proposal 2: It is proposed that no RF requirement is defined for the linkage between NTN-Gateway and gNB. RAN4 should focus on defining RF requirement for service link only.**  **Proposal 3: It is proposed to only specify BS-alike requirements for NTN.** |
| [R4-2107263](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2107263.zip) | THALES | **RAN4#98-e 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 + feeder link + NTN-Gateway as a single entity**   + **Option 2: Satellite + feeder link + NTN-Gateway + gNB as a single entity** * **FFS whether RAN4 shall define RF requirements for the linkage between NTN-Gateway and gNB**   + **Companies are encouraged to further clarify and discuss the assumption of the linkage between NTN-Gateway and gNB**   **Proposal 1:** RAN4 should not consider (Satellite + feeder link + NTN-Gateway) as a NR Relay.  Currently RAN4 has decided not to provide any RRM requirements in Rel-17 for the Repeater specifications.  **RAN4#98-e Agreements:**   * In addition, the following agreements regarding overall work were captured in the chairman meeting minutes: * RRM is out of scope based on current WID.   …   * Fixed antenna gain and pattern is assumed   **Proposal 2:** RAN4 should not consider (Satellite + feeder link + NTN-Gateway) as a NR Repeater.  **Proposal 3:** The interface between the NTN-GW and the Non-RF gNB functions is neither radiated nor conducted RF carrier.  Some architecture principles in the draft stage 2 Baseline CR (see R3-211344) have been agreed at RAN3#111-e. In line with these principles, the following figure has been provided to illustrate an example implementation of a Non-Terrestrial Network within an NG-RAN infrastructure for transparent NTN payload:    Figure B-1: NTN based NG-RAN  From the above, the following observations can be made:  **Observation 1:** The NTN-Payload, feeder link and NTN-Gateway forms a single entity called the “NTN Service link provisioning system”.  **Observation 2:** The gNB encompasses both the “NTN Service link provisioning system” and the “non NTN infrastructure gNB functions”.  **Observation 3:** The linkage between the “NTN Service link provisioning system” and the “non NTN infrastructure gNB functions” is not defined by RAN3.  **Proposal 4**: RAN4 to develop new TS capturing the radio transmission and reception requirements for the NTN-Payload.  **Observation 4:** The linkage between NTN-Gateway and modems is expected to be typically implemented with a wired connection (not necessarily RF).  **Proposal 5:** The definition of RF requirements for the linkage between NTN-Gateway and gNB should be optional and therefore can be deprioritised.  **Proposal 6:** RAN4 can consider (when required) current gNB specifications for parameters such as REFSENS.  **Proposal 7:** Specific NTN GW parameters/requirements (e.g. NTN GW REFSENS) are implementation dependent and will be adapted according to existent gNB specification.  **Proposal 8:** If required, RAN4 can reuse in Rel-17 current gNB hypotheses for the ground gNB component in NTN, as described by the technical specification TS 38.104. |
| [R4-2106897](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98bis_e/Docs/R4-2106897.zip) | Ericsson | **Observation 1: ITU-R allowed ESIM to use the FSS spectrum only in frequency range 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space).**  **Observation 2: Specific regulatory and technical conditions have been defined to allow ESIM in ITU-R to use those bands, see WRC Resolutions 156, 169 and 173.**  **Observation 3: Only ESIM under certain conditions could use FSS spectrum and only in 17.7-20.2GHz and 27.5-30.0GHz.**  **Proposal 1: The frequency ranges considered for NTN shall only be spectrum allocated by ITU to *Mobile satellite* as primary service. The 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space) frequency ranges which might also be considered for NTN band but as a specific band reserved for ESIM type of application.**  **Observation 4: Discussion on Ka-band as a NTN band under ESIM conditions are deferred until after March 2022.**  **Proposal 2: No NTN band will be specified in FR2 in Rel-17.** |