**3GPP TSG-RAN WG4 Meeting # 104bis-e R4-210XXXX**

**Electronic Meeting, 10 Oct– 19 Oct 2022**

**Agenda item:** 6.22.5

**Source:** Moderator (ZTE)

**Title:** Email discussion summary for [104-bis-e][140] NR\_NTN\_enh\_UERF

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

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

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

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| ZTE Corporation | Fei Xue (Moderator) | Xue.fei25@zte.com.cn |
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Note:

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

The e-mail discussion covers UE RF requirements for NTN in Ka-band. All contributions submitted are divided into the following Topics:

1. UE RF requirement for NTN in Ka-band

# Topic #1: UE RF requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2216559** | ZTE Corporation | Discussion on UE RF requirements for NTN in Ka-band |
| **R4-2216652** | Qualcomm Incorporated | Ka band UE RF requirements for NTN  **Observation: Handheld smartphone type devices are out of scope for above 10 GHz NTN bands.**  **Question 1: Should a common antenna be assumed for Tx and Rx, especially for a phased array antenna?**  **Question 2: Should RF filtering be assumed for VSAT devices? If so, are example data sheets or specifications available for review?**  **Question 3: Can the same IF assumptions and impact to specification be assumed for VSAT as it is for FR2 UE’s?**  **Proposal 1: Create a new UE power class 8 for “Directional VSAT UE”. Minimum EIRP, maximum TRP, and maximum EIRP are FFS.**  **Question 4: What are the appropriate regulatory requirements for VSAT UE maximum EIRP and TRP?**  **Question 5: Is a spherical coverage requirement needed for the VSAT UE?**  **Proposal: Beam correspondence requirements in terms of DL measurements to select UL beams are not suitable for NTN FDD bands above 10 GHz.**  **Question 6: What are the regulatory requirements for SEM and spurious emissions? Is ACLR needed at all for NTN?**  **Question 7: How much isolation can be assumed between uplink and downlink?**  **Question 8: What is the expected worst case noise figure of the VSAT receiver?** |

## 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 power class and UE types for VSAT UE

*Sub-topic description:\*

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

**Issue 1-1: power class**

* Proposal :
  + Proposal 1: create a new UE power class 8 for “Directional VSAT UE”. Minimum EIRP, maximum TRP, and maximum EIRP are FFS. [Qualcomm, ZTE]
  + Proposal 2: What are the appropriate regulatory requirements for VSAT UE maximum EIRP and TRP?
* Recommended WF
  + Proposal 1: create a new UE power class 8 for “Directional VSAT UE”. Minimum EIRP, maximum TRP, and maximum EIRP are FFS.

**Issue 1-2: UE type**

* Proposal :
  + Option 1: Handheld smartphone type devices are out of scope for above 10 GHz NTN bands.. [Qualcomm]
  + Option 2: other
* Recommended WF
  + Option 1: Handheld smartphone type devices are out of scope for above 10 GHz NTN bands.

### Sub-topic 1-2 Beam correspondence

*Sub-topic description:*

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

**Issue 1-2-1:**

* Proposals
  + Option 1: Beam correspondence requirements in terms of DL measurements to select UL beams are not suitable for NTN FDD bands above 10 GHz. [Qualcomm]
  + Option 2: This need more further discussions. This might be not needed since Ka-band is FDD and its frequency gap between DL and UL is quite big. [ZTE]
  + Option 3: other
* Recommend
  + Companies’ views are encouraged during the meeting.

### Sub-topic 1-3 Implementation assumption for NTN VSAT UE

*Sub-topic description:*

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

**Issue 1-3-1: Antenna assumptions**

* + Question 1: Should a common antenna be assumed for Tx and Rx, especially for a phased array antenna?. [Qualcomm]
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 1-3-2: RF filtering**

* + Question 1: Should RF filtering be assumed for VSAT devices? If so, are example data sheets or specifications available for review? [Qualcomm]
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 1-3-3: IF conversion**

* + Question 1: Can the same IF assumptions and impact to specification be assumed for VSAT as it is for FR2 UE? [Qualcomm]
* Recommend
  + Companies’ views are encouraged during the meeting.

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### Sub-topic 1-4 Other RF requirements for NTN UE in Ka-band

*Sub-topic description:*

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

**Issue 1-4: other RF requirements for NTN UE in Ka-band**

* + Proposal 1: [ZTE]

|  |  |  |
| --- | --- | --- |
| General | No | To follow the existing text from TN UE in TS 38.101-2 |
| Tx power | Yes |  |
| MPR | No | This depends on the ACLR, SEM and EVM requirement and discussion could be postponed until other requirement is more clear. |
| A-MPR | Yes | This depends on other coexistence requirement or regulatory requirement. Operators ‘s input are encouraged. |
| Configured Tx power | No | To follow the existing text from TN UE in TS 38.101-2. |
| Output Power Dynamics | No | The minimum output power for NTN VSAT UE, this could be further discussed.  Transmitter OFF power and ON-OFF time mask and power control related parameter in TS 38.101-2 could be good starting point. |
| Transmit signal quality |  |  |
| - Frequency error | No | to follow the requirement defined in TS38.101-5 where UE UL pre-compensation is still needed. |
| - Transmit modulation quality | No | To follow the existing requirement defined for TS 38.101-2, however the maximum modulation order could be further discussed similar as Rel-17 NR over NTN  Carrier leakage and in-band emission are also power class specific requirement and this could be further discussed. |
| Output RF spectrum emissions |  |  |
| - Occupied bandwidth | No | To follow the existing requirement defined for TS 38.101-2. |
| - Out of band emission |  |  |
| - SEM | No | This depends on the outcome of coexistence study. |
| - Additional SEM | Yes | Not applicable similar as NR over NTN. |
| - ACLR | No | This depends on the outcome of coexistence study. |
| - Spurious emission |  |  |
| - General | No | To follow the existing requirement defined for TS 38.101-2. |
| - For UE coexistence | Yes | Coexistence requirement for the surrounding TN bands should be considered. |
| Transmit intermodulation | No | Not applicable similar as FR2 UE RF |
| **Receiver characteristics** |  |  |
| General | No |  |
| Diversity characteristics | No |  |
| Reference sensitivity | Yes | The following requirements should be defined for NTN VSAT UE.   * Reference sensitivity power level * EIS spherical coverage requirement |
| Maximum input level | No | Further system level evaluation is needed and this requirement might be relaxed similar as Rel-17 NR NTN. |
| ACS | No | This depends on the outcome of coexistence study. |
| Blocking characteristics |  |  |
| - In-band | No | This depends on the outcome of coexistence study. |
| - Out-of-band | NA | NA |
| - Narrow band | NA | NA |
| Spurious response | NA | NA. |
| Intermodulation | NA | NA |
| Spurious emissions | No | To follow the existing requirement defined for TS 38.101-2. |

* + Proposal 2 [Qualcomm]:
* Question 5: Is a spherical coverage requirement needed for the VSAT UE?
* Question 6: What are the regulatory requirements for SEM and spurious emissions? Is ACLR needed at all for NTN?
* Question 7: How much isolation can be assumed between uplink and downlink?
* Question 8: What is the expected worst case noise figure of the VSAT receiver?s
* Recommend
  + Companies’ views are encouraged during the meeting.

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Issue 1-1-1:** *Comment*  **Issue 1-1-2:** *Comment* |
| Ericsson | Issue 1-1: Other, additional information on NTN UE type(s) would be needed. We might consider specifying one new UE PC but it’s unclear if there should only be one type of VSAT UE. Would it be the same for ESIM and fixed VSAT?  If no major impact on the signalling, it would be better to avoid any sync between TN and NTN UE PC number, both are specified in separate TSs. Could we use a new numbering of NTN UE PC? Or start from max. value as we have done for band numbering? |
| Qualcomm | Issue 1-1: Agree with proposal 1. |
| Huawei | Issue 1-1-1: Other, PC8 is not good idea since RAN2 has not specified it. As Ericsson comment that we should avoid to mix the TN UE and NTN UE. Can we just choose one term from ESIM and VSAT? Companies may be confused if these two terms appear into one spec.  Issue 1-1-2: OK with option 1. Handheld smartphone type devices are out of scope for above 10 GHz NTN bands |
| Xiaomi | Issue 1-1-2: option 1. |
| MediaTek | Issue 1-1: Fine with proposal 1. |
| ZTE | Issue 1-1: in general, we support to define new power class, maybe power class following TN FR2 power class is not good since spec for NTN UE and TN UE is separated.  For other comments to differentiate the power class for fixed VSAT or ESIM, we think that more inputs from satellite vendors are needed. |
| Apple | Issue 1-1-2: Option 1 |
| Nokia | **Issue 1-1:**We agree that a new Power Class would make sense to define for a NTN UE type. The specifics in this proposal need a bit more understanding. Is this a “fixed” VSAT meant by “directional” or since most likely all NTN UEs is directional is this also covering the “moving” VSAT or ESIM. |
| Hughes/EchoStar | **Issue 1-1: support proposal 1.** |
| Samsung | Issue 1-1: Similar view with ZTE. |
| THALES | Issue 1-1: proposal 1. |

**Issue 1-2:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Issue 1-2-1:** *Comment*  **Issue 1-2-2:** *Comment*  **Issue 1-2-3:** *Comment* |
| Qualcomm | Agree with Option 1: Handheld smartphone type devices are out of scope for above 10 GHz NTN bands  Issue 1-2-1: Option 1 |
| Huawei | Issue 1-2-1: Question is here: How can we choose the UL beam before we go option 1. More analysis and studies are needed. |
| Xiaomi | Issue 1-2-1: Option 1 and option 2 are not conflict. We also think BC capability can not directly applied to FDD bands. And we are open to discuss this. |
| MediaTek | Issue 1-2: Currently, handheld smartphone devices to support NTN bands above 10GHz are quite challenging based on link budget analysis. We think Option 1 can be baseline at this stage. Whether NTN mobile UE to support bands above 10GHz can be further discussed in future.  Issue 1-2-1: Beam correspondence is proper for TDD bands. We are fine with Option 2 currently and open for further discussion. |
| ZTE | Issue 1-2:  Agree with Option 1: Handheld smartphone type devices are out of scope for above 10 GHz NTN bands  Issue 1-2-1:  Tend to agree with option 1 |
| Apple | Issue 1-2-1: Ok with Option 1 and Option 2. However, further discussion is needed. |
| Nokia | **Issue 1-2:**We are fine to exclude handheld UEs for NTN Ka-band  **Issue 1-2-1:**In general, we agree with option 1. For option 2 we can only agree that this needs to be further discussed before we can conclude what is needed or not needed. |
| Hughes/EchoStar | Issue 1-2-1: Support Option 1 - handheld smartphone type devices can be out of scope for above 10 GHz NTN bands |
| Samsung | Issue 1-2: Opition1. |
| THALES | Issue 1-2: Option 1. |

**Issue 1-3:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Issue 1-3:** *Comment* |
| Ericsson | Issue 1-3-1: Could NTN UE have phased array antenna?  For the proposed coexistence simulation assumptions, we would only consider UE with parabolic antenna…. To be further discussed, we need more inputs from satellite UE manufacturers. |
| Qualcomm | Issue 1-3-1: In response to Ericsson, we believe a UE could have a phased array antenna that can be electrically steered, especially for a LEO constellation.  Issue 1-3-2: No filtering should be assumed, although it wouldn’t be precluded in implementation for a fixed dish antenna. In our understanding FR2 currently does not assume any filtering and implementations that use a phased array would be challenged to have filtering. Even for fixed dish antennas, the duplexers are quite large. Thus, as a common denominator, filtering should not be assumed.  Issue 1-3-3: Unless we are informed otherwise, we should assume the same IF assumptions and spec impact as FR2. |
| Huawei | Issue 1-3: phased array antenna can be assumed for ka band VSAT. If UE have to do the quick beam correspondence and steering, parabolic antenna is not a good choice for this kind of scenario. |
| ZTE | Issue 1-3-1: we tend to agree with Ericsson’s observation. At least from the coexistence perspective, we only consider the parabolic antenna.  Issue 1-3-2: no strong opinions on that.  Issue 1-3-3: no strong opinions on that. |
| Nokia | Issue 1-3-1: If we are to consider phased array antenna and not only parabolic how shall we verify the “beam correspondence” since we agree this would be completely new for FDD. |
| THALES | Please also note contribution R4-2215348 from THALES.    Figure 1. Normalised antenna pattern of a VSAT transmit antenna operating at 28 750 MHz |

**Issue 1-4:**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Issue 1-4:** *Comment* |
| Ericsson | Issue 1-4:  Proposal 1 could be a starting point, for further discussion.  Proposal 2 contains many good questions that would need further study and/or inputs from satellite UE vendors. |
| Qualcomm | We would appreciate informed input from other companies before taking decisions here. |
| Huawei | Issue 1-4:  Many thanks for ZTE and Qualcomm’s inputs. Before we jump into the RF requirements details, we have to agree some high level parts, e.g. the antenna configuration, product form, traffic mode, demands of throughput and UL/DL link budget. |
| Xiaomi | 1-4 same view as other companies. Further input and investigation on high level part especially mentioned in proposal 2 is needed before going to the detail requirement. |
| MediaTek | Issue 1-4:  Proposal 1 can be a good starting point once we get high level information/configuration. |
| ZTE | Issue 1-4:  Agree with other companies comments to have more clarification on UE types and proposal 1 could be starting point. |
| Nokia | Issue 1-4:  Good overview but we need more discussion. |
| Hughes/EchoStar | Proposal 1 is a good start but ned further checking |
| THALES | Issue 1-4: Ok for proposal 1 as starting point. |

### CRs/TPs comments collection

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | 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** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

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

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
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