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

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

**Agenda item:** 11.8.4

**Source:** Moderator (Fraunhofer HHI)

**Title:** Email discussion summary for [98e][237] NR\_NTN\_solutions\_RRM

**Document for:** Information

# Introduction

This lead summary document captures issues related to NR NTN RRM. It contains a summary of the contributions under section 11.8.4 at TSG-RAN WG4 #98e, together with identified key open issues and recommends topics/questions to be handled via email discussions. The goal of this document is also to provide recommendation on prioritization of discussion and whether any issues should be postponed.

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

* 1. Solutions for NR to support non-terrestrial networks (NTN) [NR\_NTN\_solutions]
		1. General and work plan [NR\_NTN\_solutions-Core]
		2. Use cases, deployment scenarios, and regulatory information [NR\_NTN\_solutions-Core]

\* Include exemplary bands discussion

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

According to the RAN4#98-e E-meeting Arrangements and Guidelines, the following schedule has been proposed:

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

A total of 16 TDocs have been provided for this agenda:

|  |  |  |  |
| --- | --- | --- | --- |
| **TDoc Number** | **Title** | **Source** | **For** |
| [**R4-2100646**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100646.zip) | Discussion on measurement requirements for NTN | LG Electronics UK | Discussion |
| [**R4-2100647**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100647.zip) | Discussion on timing requirements for NTN | LG Electronics UK | Discussion |
| [**R4-2100714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100714.zip) | Discussion on timing requirements for NTN | Xiaomi | Discussion |
| [**R4-2100715**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100715.zip) | Discussion on measurement requirements for NTN | Xiaomi | Discussion |
| [**R4-2100780**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100780.zip) | Discussion on UE Pre-compensation for UL synchronization for in NTN | MediaTek inc. | Discussion |
| [**R4-2100802**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100802.zip) | Discussion on NTN RRM measurement requirements | CMCC | Discussion |
| [**R4-2100819**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100819.zip) | Discussion on NTN timing requirements | CMCC | Discussion |
| [**R4-2101541**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101541.zip) | Discussion on timing requirements for NR NTN RRM | OPPO | Discussion |
| [**R4-2101712**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101712.zip) | Discussion on NTN measurement | Huawei, HiSilicon | Discussion |
| [**R4-2101864**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101864.zip) | Architecture and reference point | Ericsson | Approval |
| [**R4-2101865**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101865.zip) | RRM Timing requirements | Ericsson | Approval |
| [**R4-2101866**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101866.zip) | RRM Measurement Requirements | Ericsson | Approval |
| [**R4-2101882**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101882.zip) | NTN PVT Accuracy Aspects | THALES | Information |
| [**R4-2102813**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102813.zip) | Discussion on general issues for NTN RRM | Huawei, HiSilicon | Discussion |
| [**R4-2102814**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102814.zip) | Discussion on NTN timing related requirements | Huawei, HiSilicon | Discussion |
| [**R4-2102893**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102893.zip) | Discussion on RRM in NTN Systems | Qualcomm Incorporated | Discussion |

# Topic #1: General RAN4 RRM NTN related aspects

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

General RAN4 RRM NTN related aspects discussions are required to decide on the way forward, and to provide an initial RRM list of parameters to be considered by RAN4 RRM work.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101864 | Ericsson | **Observation 1:** If the reference point is placed at the gNB, then the gNB would experience only nominal, or at least close to nominal UL frequency and nominal UL to DL slot delay to consider. **Observation 2:** If the reference point is placed at the gNB then standardization would be simplified, since this is the existing rel-16 baseline in 3GPP and greatly increase the possibilities to reuse existing gNB RF and BB SW and HW.**Proposal 1:** Sent information LS to RAN1 with RAN4 implications for different reference points. |
| R4-2101865 | Ericsson | **Observation 1:** The delay in the TA control loop corresponds to significant part of CP already at SCS = 15 kHz.**Assumption 1:** The effect of the RTT in the TA control loop is not considered in this contribution since that is a function of the final mechanism chosen in RAN1. However CP will still have to be preserved.**Observation 2:** If gNB is time and synchronization reference then we get a requirement set which is more compatible with existing release-17 baseline.**Proposal 1:** RAN4 to investigate the impact on existing gNB requirements for the cases when satellite and gNB is time and frequency reference. |
| R4-2102813 | Huawei, HiSilicon | **Proposal 1:** RAN4 to clarify the scenarios to be considered for NTN RRM, including but not limited to* Frequency Range
* Support of CA and DC
* Deployment of cells/beams
* Mobility

**Proposal 2:** RAN4 to consider defining the NTN RRM requirements for * Basic mobility procedure (cell reselection and HO)
* RRM measurement (delay and accuracy)
* Serving cell related (RA, timing and RLM)
 |

## 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: Reference point (RP) to be considered for time and frequency synchronization

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

**Issue 1-1: Send information LS to RAN1**

* Proposals
	+ Option 1: Send information LS to RAN1 with RAN4 implications for different reference points.
	+ Option 2: TBA
* Recommended WF
	+ TBA

**Issue 1-2: Possibility of using satellite and gNB as time and frequency reference**

* Proposals
	+ Option 1: RAN4 to investigate the impact on existing gNB requirements for the cases when satellite and gNB is time and frequency reference.
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 1-2: NTN Use cases and scenarios

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

**Issue 1-3: Scenarios to be considered for NTN RRM**

* Proposals
	+ Option 1: RAN4 to clarify the scenarios to be considered for NTN RRM, including but not limited to
		- Frequency Range
		- Support of CA and DC
		- Deployment of cells/beams
		- Mobility
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 1-3: NTN RRM requirements

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

**Issue 1-4: Definition of NTN RRM requirements**

* Proposals
	+ Option 1: RAN4 to consider defining the NTN RRM requirements for
		- Basic mobility procedure (cell reselection and HO)
		- RRM measurement (delay and accuracy)
		- Serving cell related (RA, timing and RLM)
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Recommendations on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #2: GNSS requirements

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

The topic should at least cover:

* GNSS used on UE, precision and accuracy requirements
* GNSS used on Satellite, precision and accuracy requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100780 | MediaTek Inc. | **Observation 5:** GNSS accuracy in the device and on-board of satellite are expected to be sufficiently accurate, i.e. ±3 m.**Proposal 3:** No RRM requirement impacted by GNSS accuracy. |
| R4-2102813 | Huawei, HiSilicon | **Proposal 3:** RAN4 to discuss whether GNSS accuracy is taken as * An assumption to define other requirements, or
* An implicit or explicit requirements
 |
| R4-2102814 | Huawei, HiSilicon | **Proposal 2:** RAN4 needs to study the reference GNSS scenario for deriving the UE position error.* Option 1: Considering worst scenario.
* Option 2: Considering a typical scenario, with introducing the GNSS signal parameters for this scenario.
 |
| R4-2100819 | CMCC | **Proposal 5:** Both explicit way and implicit way can be considered to specify the UE GNSS positioning accuracy requirement.**Proposal 6:** Defining the requirements without on-board GNSS as the baseline. |

## 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: GNSS usage

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

**Issue 2-1: Definition of GNSS requirements**

* Proposals
	+ Option 1: Defining the requirements **without** on-board GNSS as the baseline.
	+ Option 2: Defining the requirements **with** on-board GNSS as the baseline.
* Recommended WF
	+ TBA

### Sub-topic 2-2: GNSS accuracy

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

**Issue 2-2: Impact of GNSS accuracy on RRM requirements**

* Proposals
	+ Option 1: RRM requirements are **not** impacted by GNSS accuracy
	+ Option 2: RRM requirements are impacted by GNSS accuracy
* Recommended WF
	+ TBA

**Issue 2-3: GNSS accuracy requirement**

* Proposals
	+ Option 1: GNSS accuracy is taken as an assumption to define other requirements
	+ Option 2: GNSS accuracy is taken as an implicit or explicit requirement
* Recommended WF
	+ TBA

**Issue 2-4: Reference GNSS scenario**

* Proposals
	+ RAN4 needs to study the reference GNSS scenario for deriving the UE position error
		- Option 1: considering worst case scenario
		- Option 2: Considering a typical scenario, with introducing the GNSS signal parameters for this scenario
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #3: PVT Satellite precision

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2101882 | Thales | **Proposal 1:** It is assumed that the NTN infrastructure (NTN control function) can provide updates of the actual Ephemeris at the necessary frequency to prevent excessive ageing that would prevent successful uplink synchronisation. |
| R4-2102814 | Huawei, HiSilicon | **Observation 1:** RAN1’s decision on the format of the satellite ephemeris parameters are needed to deriving the UE position error. |

## 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: Requirements for PVT computation and distribution

**Issue 3-1: NTN PVT Accuracy Aspects**

* Proposals
	+ Option 1: It can be assumed that the NTN infrastructure (NTN control function) can provide updates of the actual Ephemeris at the necessary frequency to prevent excessive ageing that would prevent successful uplink synchronisation.
	+ Option 2: RAN1’s decision on the format of the satellite ephemeris parameters are needed to deriving the UE position error.
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #4: NTN UL Time synchronization requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100647 | LG Electronics | **Proposal 1**: Wait for RAN1 decision since UL synchronization requirement highly depends on RAN1 progress. |
| R4-2100714 | Xiaomi | **Observation 1:** The accuracy of UE specific TA estimation may depend on the accuracy of GNSS positioning and the accuracy of ephemeris information calculation.**Proposal 1:** RAN4 is to introduce the accuracy requirement for the UE specific TA estimation for an NTN UE in RRC\_idle and RRC\_inactive mode.**Observation 2:** The TA adjustment accuracy requirement depends on whether the common TA mechanism is introduced or not, which is being discussed in RAN1.**Proposal 2:** the TA adjustment accuracy can be defined as the same ratio of the TA adjustment step size (±1/4 of TA adjustment step) specified for legacy NR. |
| R4-2100780 | MediaTek Inc. | **Observation 1:** By using propagation method based on gravity with SIB periodicity of 10s:* The timing error is 0.003 us, which is only about 0.01\*Te in SCS of 15kHz, as specified in TS 38.133.

**Observation 2:** By using propagation method based on linear extrapolation with SIB periodicity of 2s:* The timing error is 0.04 us, which is around 0.12\*Te in SCS of 15kHz
* Te is the initial transmission timing error requirement as specified in Table 7.1.2-1, TS38.133.

**Observation 3:** UL timing error contributed by UE pre-compensate satellite Delay can be ranged from 0.01\*Te ~ 0.12\*Te.**Proposal 1:** No need to relax Te specified in in Table 7.1.2-1 for NTN UEs. |
| R4-2100819 | CMCC | **Proposal 1**: For initial transmission timing, the existing *Te* requirements defined in Table 7.1.2-1 can be a baseline for R17 NTN network.**Proposal 2**: For LEO NTN network gradual timing adjustment, the maximum amount of the magnitude of the timing change in one adjustment and the maximum aggregate adjustment rate should be studied, such as Tq’ per X ms.* evaluate the value X based on service demand and UE capability
* calculate Tq’, i.e., Tq’≥(79Tc+Tq/200)×X.

**Proposal 3:** The R16 gradual timing adjustment requirements can be a baseline for GEO NTN network.**Proposal 4:** UE timer accuracy can be kept as that in R16 specification.**Observation 1:** The UE evaluated TA error mainly consists of inaccuracies of UE position and satellite position.**Observation 2:** How to capture the TA update requirements in connected mode should be based on RAN1 agreements. |
| R4-2101541 | OPPO | **Proposal 1:** RAN4 should wait for RAN1’s agreement before concluding on TA adjustment accuracy.**Proposal 2:** NTN delay compensation has impact on TA error.**Proposal 3:** RAN4 further investigate Te based on current NR TN requirements.**Proposal 4:** The Gradual timing adjustment rules have to be modified for NTN, including the parameter Tq (Maximum Autonomous Time Adjustment Step) and Tp (Minimum Aggregate Adjustment rate).**Proposal 5:** Reuse the requirements of NTA\_offset，and UE timer accuracy as in current TS 38.133 specification. |
| R4-2101865 | Ericsson | **Observation 3:** It is important to control the size of Te. The reason for this is that we have to preserve CP.**Proposal 2:** Keep existing Te requirements as defined in TS 38.133, Table 7.1.2-1: Te Timing Error Limit**Observation 4:** In order to preserve CP we get that ΔUE-pos + ΔSat-pos + ΔUE\_timing\_estimate < Te**Observation 5:** A worst case maximum delay variation will trigger a gradual timing adjustment every 10 to 6 ms for FR1 and every 3 to 2.5 ms for FR2 given existing gradual timing adjustment requirements.**Observation 6:** The parameter Tq will have to be modified. For a period of 200 ms we could have a worst case delay variation of 246 \* 64 Tc.**Proposal 3:** The parameter Tq and the maximum aggregate adjustment rate will have to be investigated.**Proposal 4:** Keep  as in existing TS 38.133 specification [3].**Proposal 5:** Keep UE timer accuracy as in existing TS 38.133 specification [3].**Observation 7:** final analysis of Timing Advance adjustment accuracy has to consider the total error budget for regulating TA during a call: ΔUE-pos, ΔSat-pos, Timing Advance adjustment accuracy and TA command resolution error.**Proposal 6:** Final Timing Advance adjustment accuracy depends on the mechanism chosen in RAN1 specification and the final total uncertainty budget. However, Timing Advance adjustment accuracy should scale inversely proportional to SCS (and in current specification it is ±1/4 TA-step (at SCS = 15 kHz)). |
|  |  |  |
| R4-2102814 | Huawei, HiSilicon | **Proposal 1:** For NTN networks, RAN4 needs to study how to define UE transmit timing requirements in RRC idle/inactive mode.* Option 1: Define the requirements on UE transmit timing error limit and timing advance adjustment accuracy, provided that:
	+ UE self-estimating error of NTA is counted into the UE transmit timing error.
	+ Timing advance adjustment accuracy is derived from the sampling interval with minimum UL bandwidth.
* Option 2: Define the requirements on UE transmit timing error limit and timing advance adjustment accuracy, provided that:
	+ UE self-estimating error of NTA will be counted into the timing advance adjustment error.
	+ UE transmit timing error is derived from the UE capability of estimating downlink timing
* Option 3: Define the requirements on UE transmit timing error limit, UE self-estimating accuracy of NTA and timing advance adjustment accuracy, provided that:
	+ UE transmit timing error is derived from the UE capability of estimating downlink timing
	+ Timing advance adjustment accuracy is derived from the sampling interval with minimum UL bandwidth.

**Proposal 3:** For NTN networks, RAN4 needs to define UE transmit timing requirements in RRC connected mode, with using the same methodology in RRC idle/inactive mode.**Proposal 4:** For NTN networks, RAN4 need to study the UE autonomous timing adjustment requirements in RRC connected mode, which can be derived from the downlink timing drift and UE self-estimation TA variation. |

## 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: Timing adjustment

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

**Issue 4-1: TA adjustment accuracy**

* Proposals
	+ Option 1: RAN4 should wait for an agreement in RAN1 before concluding on TA adjustment accuracy.
	+ Option 2: Final Timing Advance adjustment accuracy depends on the mechanism chosen in RAN1 specification and the final total uncertainty budget. However, Timing Advance adjustment accuracy should scale inversely proportional to SCS (and in current specification it is ±1/4 TA-step (at SCS = 15 kHz)).
	+ Option 4: The TA adjustment accuracy can be defined as the same ratio of the TA adjustment step size (±1/4 of TA adjustment step) specified for legacy NR.
* Recommended WF
	+ TBA

**Issue 4-2: Gradual timing adjustment**

* Proposals
	+ Option 1: The Gradual timing adjustment rules have to be studied and modified for NTN by RAN4, including the parameter Tq (Maximum Autonomous Time Adjustment Step) and Tp (Minimum Aggregate Adjustment rate).
	+ Option 1a: For LEO NTN network gradual timing adjustment, the maximum amount of the magnitude of the timing change in one adjustment and the maximum aggregate adjustment rate should be studied, such as Tq’ per X ms.
		- evaluate the value X based on service demand and UE capability
		- calculate Tq’, i.e., Tq’≥(79Tc+Tq/200)×X
	+ Option 1b: For NTN networks, RAN4 need to study the UE autonomous timing adjustment requirements in RRC connected mode, which can be derived from the downlink timing drift and UE self-estimation TA variation.
	+ Option 2: The R16 gradual timing adjustment requirements can be a baseline for GEO NTN network.
* Recommended WF
	+ TBA

**Issue 4-3: Impact of delay compensation on TA error**

* Proposals
	+ Option 1: NTN delay compensation has impact on TA error.
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 4-2: Timing Error requirements and Timer accuracy

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

**Issue 4-4: Te Timing Error Limit**

* Proposals
	+ Option 1: Use existing Te requirements defined in TS 38.133, Table 7.1.2-1, as baseline for R17 NTN networks
	+ Option 2: RAN4 should further investigate Te based on current NR TN requirements
* Recommended WF
	+ TBA

**Issue 4-5:** $N\_{TA}$ **Offset and UE timer accuracy**

* Proposals
	+ Option 1: Reuse the requirements for $N\_{TA}$ Offset and UE time accuracy as defined in the current TS 38.133 specification
	+ Option 2: TBA
* Recommended WF
	+ Reuse the requirements for $N\_{TA}$ Offset and UE time accuracy as defined in the current TS 38.133 specification
		1. Sub-topic 4-3: UE transmit timing requirements

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

**Issue 4-6: UE transmit timing requirements in RRC idle/active mode**

* Proposal: For NTN networks, RAN4 needs to study how to define UE transmit timing requirements in RRC idle/inactive mode.
	+ Option 1: Define the requirements on UE transmit timing error limit and timing advance adjustment accuracy, provided that:
		- UE self-estimating error of NTA is counted into the UE transmit timing error.
		- Timing advance adjustment accuracy is derived from the sampling interval with minimum UL bandwidth.
	+ Option 2: Define the requirements on UE transmit timing error limit and timing advance adjustment accuracy, provided that:
		- UE self-estimating error of NTA will be counted into the timing advance adjustment error.
		- UE transmit timing error is derived from the UE capability of estimating downlink timing
	+ Option 3: Define the requirements on UE transmit timing error limit, UE self-estimating accuracy of NTA and timing advance adjustment accuracy, provided that:
		- UE transmit timing error is derived from the UE capability of estimating downlink timing
		- Timing advance adjustment accuracy is derived from the sampling interval with minimum UL bandwidth.
	+ Option 4: RAN4 is to introduce the accuracy requirement for the UE specific TA estimation for an NTN UE in RRC\_idle and RRC\_inactive mode.
* Recommended WF
	+ TBA

**Issue 4-7: UE transmit timing requirements in RRC connected mode**

* Proposals
	+ Option 1: For NTN networks, RAN4 needs to define UE transmit timing requirements in RRC connected mode, with using the same methodology in RRC idle/inactive mode
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #5: NTN UL frequency synchronization requirement

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100780 | MediaTek Inc. | **Observation 1:** By using propagation method based on gravity with SIB periodicity of 10s:* The frequency error is 1.23Hz, which is less than 0.001 ppm at fc = 2GHz.

**Observation 2:** By using propagation method based on linear extrapolation with SIB periodicity of 2s:* The frequency error is 0.42Hz, which is around 0.0002 ppm at fc = 2GHz.

**Observation 4:** UL frequency error contributed by UE pre-compensate satellite Doppler is small and can meet the maximum UL frequency error of ± 0.1ppm for UL transmission.**Proposal 2:** Keep the legacy UL frequency error requirement of ± 0.1ppm for NTN UEs. |
| R4-2102893 | Qualcomm Inc. | **Proposal 1:** RAN4 to investigate factors that can affect time/frequency pre-compensation accuracy requirements, e.g.* Residual time/frequency error at UE side due to mobility and inaccurate position information, e.g. GNSS accuracy and frequency of reading GNSS information
* Residual time/frequency error in LEO due to a fast movement of LEO and an inaccurate PVT information in terms of precision and/or update frequency (subject to higher layer design)
* Residual time/frequency error in GEO if there is a non-negligible local position change
* FFS on whether and what effects should be considered for feeder link
* FFS on pre-compensation for HAPs and HIBS
* FFS on whether and how to consider location-based UL transmission power autonomous adjustment
 |

## Open issues summary

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

### Sub-topic 5-1: Frequency accuracy requirements

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

**Issue 5-1: UL frequency error requirement**

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

**Issue 5-2: Time/Frequency pre-compensation accuracy requirements**

* Proposals
	+ Option 1: RAN4 to investigate factors that can affect time/frequency pre-compensation accuracy requirements, e.g.
		- Residual time/frequency error at UE side due to mobility and inaccurate position information, e.g. GNSS accuracy and frequency of reading GNSS information
		- Residual time/frequency error in LEO due to a fast movement of LEO and an inaccurate PVT information in terms of precision and/or update frequency (subject to higher layer design)
		- Residual time/frequency error in GEO if there is a non-negligible local position change
		- FFS on whether and what effects should be considered for feeder link
		- FFS on pre-compensation for HAPs and HIBS
		- FFS on whether and how to consider location-based UL transmission power autonomous adjustment
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #6: NTN Measurements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100646 | LG Electronics | **Proposal 1**: Measurement for intra NTN mobility should be discussed with priority in RAN4.**Proposal 2**: Define the RRM requirement for ephemeris and UE location assisted NTN mobility.**Observation 1:** Using SMTC or MG without propagation delay information from satellite, NTN system performance could be dreaded. **Proposal 3:** Consider propagation delay information from satellite/HAPS to configure SMTC or MG, and FFS for detail procedure.**Observation** : RRM measurement performance could be affected by update period and accuracy of satellite/HAPS PVT and UE location information**Proposal 4:** RAN4 needs to consider the update period and accuracy of satellite/HAPS PVT and UE location information when defining the NTN RRM measurement requirement. |
| R4-2100715 | Xiaomi | **Observation 1:** The existing cell reselection mechanism defined for TN system is not suitable for NTN system due to the unobvious near-far effect for RSRP/RSRQ measurement.**Proposal 1:** RAN4 is to identify whether the existing cell reselection delay requirement based on the existing S criteria can be reused or not for NTN scenarios.**Proposal 2:** RAN4 is to define the RRM requirements for satellite/HAPS ephemeris based cell selection and reselection once RAN2 completes the cell reselection procedure for NTN.**Proposal 3:** Both intra-NTN cell reselection and inter NTN-TN cell resection should be supported.**Proposal 4:** RAN4 is to study whether the existing conditional handover delay requirement based on the CHO procedure and execution condition defined in Rel-16 can be reused or not for NR NTN scenarios.**Proposal 5:** RAN4 is to define the RRM requirements for time/timer and location based CHO triggering event.**Observation 2:** The propagation time difference between serving cell and target neighbour cell will cause the reference signal window of target neighbour cell is not within the measurement gap window configured by the serving cell.**Proposal 6:** RAN4 is to study the enhancement on measurement gap configuration for NR NTN system. |
| R4-2101712 | Huawei, HiSilicon | **Observation 1:** The existing accuracy of measurement quantity in current spec can be reused for NTN scenario.**Observation 2:** CHO handover requirements can be discussed in RAN4 in NTN. If RAN2 introduces new handover conditions, RAN4 needs to evaluate the related accuracy.**Observation 3:** The issue of SMTC and gap window is suggested to be considered in RAN4. |
| R4-2101866 | Ericsson | **Observation 1:** It is practically feasible to receive GNSS positioning signals without any measurement gap or interruption in 3GPP radio reception or transmission.**Proposal 1:** No interruptions or measurement gaps are allowed for GNSS measurements during NTN operation.**Proposal 2:** RAN4 shall consider requirements for A-GNSS in 38.171 as a starting point when defining requirements for further RRM procedures based on UE position. RAN4 needs to verify if existing A-GNSS requirements are sufficient, considering the impact that positioning will have on the further RRM requirements which assume knowledge of UE position**Proposal 3:** RAN4 further discusses measurements in NTN operation for both idle and connected mode once further progress is made in RAN1 and RAN2.**Proposal 4:** RAN4 to discuss about measurements supporting TN / NTN mobility, once the Intra NTN mobility has sufficiently progressed. Intra NTN mobility refers to idle and connected mode mobility between NTN cells (e.g. intra or inter satellite). |
| R4-2102893 | Qualcomm Inc. | **Proposal 2:** RAN4 discussion for mobility and measurement requirements should be limited to the following scenarios until RAN4 receives specific inputs from RAN1/2:* from NTN to NTN for RRC Connected mode
* between NTN and TN for only RRC Inactive/Idle modes
* between GEO type satellites
* between LEO type satellites at the same altitude
	+ Do not consider a scenario where UE monitors both earth fixed and earth moving cells
* between HAPs (FFS on HIBSs)

**Proposal 3:** RAN4 to discuss and define a set of reference models including satellite types and corresponding attributes in the table below. |
| R4-2100802 | CMCC | **Table on NTN RRM measurement requirements** |

## Open issues summary

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

### Sub-topic 6-1: General RRM NTN measurement requirements

*During RAN4#97-e, an initial discussion on NTN related parameters was started. Possible parameters to be treated with priority were identified. In the Way Forward (R4-2017268), the following NTN measurement related were listed:*

Table 1: NTN Parameters related to Measurement Procedures - Possible parameters to be treated with Priority

|  |  |
| --- | --- |
| Parameter Name | Specific parameter requirement |
| General measurement requirement | Measurement gap |
| UE Measurement capability |
| NR intra-frequency measurements | Requirements applicability |
| NR inter-frequency measurements | Requirements applicability |

Table 2: NTN Parameters related to Measurement Performance Requirements (NR Measurements only) - Possible parameters to be treated with Priority

|  |
| --- |
| Parameter Name/Accuracy Requirement |
| Intra-frequency RSRP accuracy requirements for FR1: * Specific-NTN Absolute SS-RSRP Accuracy
* Specific-NTN Relative SS-RSRP Accuracy
 |
| Inter-frequency RSRP accuracy requirements for FR1* Specific-NTN Absolute SS-RSRP Accuracy

Specific-NTN Relative SS-RSRP Accuracy |
| RSRP Measurement Report Mapping |

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

**Issue 6-1: General RRM requirements**

* Proposals
	+ Option 1: RAN4 further discusses measurements in NTN operation for both idle and connected mode once further progress is made in RAN1 and RAN2.
	+ Option 2: The following RRM requirements are the candidates to be discussed for NTN RRM measurement. More items may be added pending on the progress in other WGs.

|  |  |  |
| --- | --- | --- |
| Mobility States | Parameter | Parameter Name |
| RRC\_IDLE /INACTIVE state  | Cell Re-selection | UE measurement capability |
| Measurement and evaluation of serving cell |
| Measurements of intra-frequency NR cells |
| Measurements of inter-frequency NR cells |
| RRC\_CONNECTED state  | Handover Parameters - NR Handover | NR Handover |
| RRC Connection Mobility Control | RRC Re-establishment |
| Random access |
| RRC Connection Release with Redirection |
| General measurement requirement | Measurement gap |
| UE Measurement capability |
| NR intra-frequency measurements | Requirements applicability |
| NR inter-frequency measurements | Requirements applicability |
| NR measurement accuracy requirements | Intra-frequency SS-RSRP/RSRQ/SINR accuracy, including absolute and relative accuracy |
| Inter-frequency SS-RSRP/RSRQ/SINR accuracy, including absolute and relative accuracy |
| SS-RSRP/RSRQ/SINR Measurement report mapping |

* + Option 3: TBA
* Recommended WF
	+ TBA

**Issue 6-2: RRM procedures based on UE position**

* Proposals
	+ Option 1: RAN4 shall consider requirements for A-GNSS in 38.171 as a starting point when defining requirements for further RRM procedures based on UE position. RAN4 needs to verify if existing A-GNSS requirements are sufficient, considering the impact that positioning will have on the further RRM requirements which assume knowledge of UE position
	+ Option 2: RAN4 needs to consider the update period and accuracy of satellite/HAPS PVT and UE location information when defining the NTN RRM measurement requirement.
* Recommended WF
	+ TBA

**Issue 6-3: Use of propagation delay information**

* Proposals
	+ Option 1: Consider propagation delay information from satellite/HAPS to configure SMTC or MG, and FFS for detail procedure.
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 6-2: Mobility

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

**Issue 6-4: Measurements for intra- / inter-cell mobility**

* Proposals
	+ Option 1: Measurement for intra NTN mobility should be discussed with priority in RAN4.
	+ Option 2: RAN4 to discuss about measurements supporting TN / NTN mobility, once the Intra NTN mobility has sufficiently progressed. Intra NTN mobility refers to idle and connected mode mobility between NTN cells (e.g. intra or inter satellite).
	+ Option 3: RAN4 discussion for mobility and measurement requirements should be limited to the following scenarios until RAN4 receives specific inputs from RAN1/2
		- from NTN to NTN for RRC Connected mode
		- between NTN and TN for only RRC Inactive/Idle modes
		- between GEO type satellites
		- between LEO type satellites at the same altitude
			* Do not consider a scenario where UE monitors both earth fixed and earth moving cells
		- between HAPs (FFS on HIBSs)
	+ Option 4: Both intra-NTN cell reselection and inter NTN-TN cell resection should be supported.
* Recommended WF
	+ TBA

**Issue 6-5: Cell selection and reselection**

* Proposals
	+ Option 1:
		- RAN4 is to study/identify whether the existing cell reselection and conditional handover delay requirement based on the existing S criteria can be reused or not for NTN scenarios.
		- RAN4 is to define the RRM requirements for satellite/HAPS ephemeris based cell selection and reselection once RAN2 completes the cell reselection procedure for NTN.
* Recommended WF
	+ TBA

**Issue 6-6: Location assisted mobility**

* Proposals
	+ Option 1: Define the RRM requirement for ephemeris and UE location assisted NTN mobility
	+ Option 2: RAN4 is to define the RRM requirements for time/timer and location based CHO triggering event.
* Recommended WF
	+ TBA
		1. Sub-topic 6-3: Measurement gap

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

**Issue 6-7: Interruption or measurement gaps for GNSS measurements**

* Proposals
	+ Option 1: No interruptions or measurement gaps are allowed for GNSS measurements during NTN operation.
* Recommended WF
	+ TBA

**Issue 6-8: Measurement gaps for mobility measurements**

* Proposals
	+ Option 1: RAN4 is to study the enhancement on measurement gap configuration for NR NTN system.
* Recommended WF
	+ TBA

**Issue 6-9: SMTC and gap window misalignment**

* Proposals
	+ Option 1: The issue of SMTC and gap window is suggested to be considered
* Recommended WF
	+ TBA
		1. Sub-topic 6-4: Reference models

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

**Issue 6-10: Reference models**

**Note: Simulation assumptions are also discussed in [98e][311] NTN\_Solutions\_Part2 -> simulation assumptions and bands are discussed in [98e][310] NTN\_Solutions\_Part1 -> bands, architecture and RF. We should align model selection with [98e][311] and bands with [98e][310].**

* Proposals
	+ Option 1: RAN4 to discuss and define a set of reference models including satellite types and corresponding attributes in the table below

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Attributes** | **GEO-S** | **GEO-Ka** | **LEO-S-f** | **LEO-Ka-f** | **LEO-S-m** | **LEO-Ka-m** | **HAPS-S-f** |
| **Satellite altitude** | 35786km | 35786km | 600km [and X>600km] | 600km [and X>600km] | 600km [and X>600km] | 600km [and X>600km] | [50]km |
| **Carrier frequency of serving link** | S band | Ka band | S band | Ka band | S band | Ka band | S band |
| **Beam on earh** | Earth fixed beams | Earth fixed beams | Earth fixed beams | Earth fixed beams | Earth moving beams | Earth moving beams | Earth fixed beams [and/or Earth moving] |
| **Relative speed of satellite/UAS with respect to earth** | Negligible | Negligible | 7.56km/s for 600km[and Ykm/s for Xkm] | 7.56km/s for 600km[and Ykm/s for Xkm] | 7.56km/s for 600km[and Ykm/s for Xkm] | 7.56km/s for 600km[and Ykm/s for Xkm] | [Z]km/s |
| **Typical Min/Max NTN beam foot print diameter** | [100]km/[3500]km (may need to be redefined for the S band) | [100]km/[3500]km (may need to be redefined for the Ka band) | [50]km/[1000]km (may need to be redefined for the S band) | [50]km/[1000]km (may need to be redefined for the Ka band) | [50]km/[1000]km (may need to be redefined for the S band) | [50]km/[1000]km (may need to be redefined for the Ka band) | need to be defined considering the altitude and the band |
| **Min/Max propagation delay contribution to the round trip delay on the radio interface between the gNB and the UE** | 477.48ms/541.46ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter) | 477.48ms/541.46ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter) | 8ms/25.77ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 8ms/25.77ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 8ms/25.77ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 8ms/25.77ms (for the Maximum value, may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | need to be calculated based on the Max HAPS beam foot print diameter and the HAPS’s altitude and reletive movement |
| **Max delay variation as seen by the UE** | Negligible | Negligible | Up to +/-40us/sec (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | Up to +/-40us/sec (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | Up to +/-40us/sec (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | Up to +/-40us/sec (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | need to be calculated based on the Max HAPS beam foot print diameter and the HAPS’s altitude and reletive movement |
| **Channel bandwidth** | 20MHz for each DL and UL | 800MHz for each DL and UL | 20MHz for each DL and UL | 800MHz for each DL and UL | 20MHz for each DL and UL | 800MHz for each DL and UL | [20]MHz for each DL and UL |
| **Terminal type** | Handheld device, PC[3] | VSAT | Handheld device, PC[3] | VSAT | Handheld device, PC[3] | VSAT | Handheld device, PC[3] |
| **Terminal speed** | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined |
| **Max differential delay (b/w edge of satellite coverage and Nadir)****Table 5.3.5-1 of TR38.811/ Table 4.2-2 of TR38.821** | 16ms/10.3 (may need to be recalculated based on the beam foot print diameter) | 16ms/10.3 (may need to be recalculated based on the beam foot print diameter) | 4.4ms/3.12ms(for 600km and 3.18ms for 1200km) (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 4.4ms/3.12ms(for 600km and 3.18ms for 1200km) (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 4.4ms/3.12ms(for 600km and 3.18ms for 1200km) (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 4.4ms/3.12ms(for 600km and 3.18ms for 1200km) (may need to be recalculated based on the Max NTN beam foot print diameter and the satellite’s altitude and reletive movement) | 0.697ms (may need to be recalculated based on the Max HAPS beam foot print diameter and the HAPS’s altitude and reletive movement) |
| **Max Doppler shift** | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined |
| **Max Doppler variation [Hz/sec]** | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined | need to be defined |
| **UE antenna pattern and polarization** | Quasi Isotropic linear polarization [and Co-phased array dual linear polarization] | Circular polarization and Co-phased array dual linear polarization | Quasi Isotropic linear polarization [and Co-phased array dual linear polarization] | Circular polarization and Co-phased array dual linear polarization | Quasi Isotropic linear polarization [and Co-phased array dual linear polarization] | Circular polarization and Co-phased array dual linear polarization | Quasi Isotropic linear polarization [and Co-phased array dual linear polarization] |

* + Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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

## Summary for 1st round

### Open issues

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

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

*Suggestion on WF/LS assignment*

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

1. Topic #7: RRM requirements for beam switching

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

* 1. Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100715 | Xiaomi | **Proposal 7:** RAN4 is to study the RRM requirements for beam switching once RAN1 has determined the final PCI mapping mechanism for NTN scenario. |

* 1. Open issues summary

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

* + 1. Sub-topic 7-1: Beam switching

**Issue 3-1: RRM requirements for beam switching**

* Proposals
	+ Option 1: RAN4 is to study the RRM requirements for beam switching once RAN1 has determined the final PCI mapping mechanism for NTN scenario.
	+ Option 2: TBA
* Recommended WF
	+ TBA
	1. Companies views’ collection for 1st round
		1. Open issues

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

* 1. Summary for 1st round
		1. Open issues

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

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

*Suggestion on WF/LS assignment*

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

* 1. Discussion on 2nd round (if applicable)
	2. Summary on 2nd round (if applicable)

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

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