**3GPP TSG-RAN WG4 Meeting #** **104-e R4-2214134**

**Electronic Meeting, Aug. 2022**

**Agenda item:** 9.11.8

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary: [104-e][214] NR\_NTN\_solutions\_RRM\_1

**Document for:** Information

# Introduction

*The summary covers the contributions submitted under the following AIs*

* *9.11.5 RRM core requirement maintenance*
	+ *9.11.5.1 Measurement procedure requirements*
	+ *9.11.5.2 Others*

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

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Qualcomm Incorporated | CH Park | chparkqc@qti.qualcomm.com |
| Xiaomi | Xuhua Tao | taoxuhua@xiaomi.com |
| LG Electronics | Jin-yup Hwang | jinyup.hwang@lge.com |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

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)

# Open issues

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

## Open issues summary and Companies views’ collection for 1st round

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

|  |  |  |
| --- | --- | --- |
| R4-2211849 | Apple | **Proposal 1: for SMTC inside MG and SMTC outside MG, as long as the proximity distance between MG and SMTC outside MG are less than the proximity distance threshold, SMTC inside MG and SMTC outside MG are considered as colliding case.****Proposal 2: Scaling factor due to overlapping MG will be introduced to define the delay requirement when concurrent MGs are fully overlapped.**  |
| R4-2211957 | Xiaomi | **Proposal 1: RAN4 shall define the UE behavior during gap collision for fully overlapped case.****Proposal 2: For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2.** |
| R4-2212864 | Nokia, Nokia Shanghai Bell | **Proposal 1: RAN4 to discuss and specify requirements for the measurement of distance between the UE and the SAN for RRM purposes.****Proposal 2: The satellite ephemeris information to be updated for calculating the distance between the UE and the SAN at [the beginning of every SFN].** **Proposal 3: RAN4 to discuss if the UE may use satellite information for mobility (handover and cell reselection purposes) even if there is no running validity timer at the UE side.**  |
| R4-2213355 | Ericsson | **Proposal 1: Sharing rule shall be applied in fully overlapped cases.** |
| R4-2213520 | Huawei, HiSilicon | **Proposal 1: Adopt priority rule also for non-fully overlapping MGs.****Proposal 2: Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO.****Proposal 3: Send LS to ask RAN2 to introduce a new signalling for enabling enhancement cell reselection measurement for LEO.** |
| R4-2212865 | Nokia, Nokia Shanghai Bell | **Proposal 1: Modify the requirements such that the reference for (*N*TA *+ N*TA-offset *+ N*TA,common *+ N*TA,UE-specific)*×*Tc accounts for updates in *N*TA,commonand *N*TA,UE-specific.****Proposal 2: RAN4 to decide what is the reference point in time for updated values of *N*TA,commonand *N*TA,UE-specific:** **Option 1: The beginning of a DL frame at the UE side.** **Proposal 3: Include the requirements for the validity timer in the specifications.** **Proposal 4: Introduce requirements for *N*TA,common.****Proposal 5: Introduce requirements for *N*TA,UE-specific.** |
| R4-2213518 | Huawei, HiSilicon | **Proposal 1: Remove the requirements for unknown case for paging interruption.****Proposal 2: Define NTN re-establishment requirements as in Table 1 and Table 2.****Table 1: NTN re-establishment requirements for intra-frequency**

|  |  |  |
| --- | --- | --- |
| **Serving cell**  | **FR of target NR**  | **Tidentify\_intra\_NR [ms]** |
| **SSB Ês/Iot (dB)** | **cell** | **Known NR cell** | **Unknown NR cell** |
| ≥ -8 | FR1 | MAX (200 ms, 5 x TSMTC) | Kmulti\_SMTC \* MAX (800 ms, 10 x TSMTC) |
| < -8 | FR1 | N/A | [6400]Note1 |
| Note 1: The UE is not required to successfullyidentify a cell on any NR frequency layer when TSMTC > 20 ms and serving cell SSB Ês/Iot < -8 dB.Note 2: Kmulti\_SMTC is defined in clause 9.2C.5.1. |

**Table 2: NTN re-establishment requirements for inter-frequency**

|  |  |  |
| --- | --- | --- |
| **Serving cell SSB Ês/Iot (dB)** | **FR of target NR cell** | **Tidentify\_inter\_NR, i [ms]** |
|  |  | **Known NR cell** | **Unknown NR cell** |
| ≥ -8 | FR1 | MAX (200 ms, 6 x TSMTC, i) | K\_satellite \* MAX (800 ms, 13 x TSMTC, i) |
| < -8 | FR1 | N/A | [6400]Note1 |
| Note 1: The UE is not required to successfully identify a cell on any NR frequency layer when TSMTC,i > 20 ms and serving cell SSB Ês/Iot < -8 dB.Note 2: K\_satellite is defined in clause 9.3C.4. |

**Proposal 3: Define NTN re-direction requirements as in Table 3.**

|  |  |
| --- | --- |
| **FR of target NR cell** | **Tidentify-NR** |
| FR1 | K\_satellite \* MAX (680 ms, 11 x Trs) |
| Note 1: If the UE has been provided with higher layer signaling of *smtc2*specified in TS 38.331 [2] prior to the redirection command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.Note 2: K\_satellite is defined in clause 9.3C.4. |

 |
| R4-2214058 | Ericsson | **Proposal #1**: The satellite access bands n255 and n256 are assigned to same band group for applicability of RRM requirements in TS 38.133. NR\_FDD\_SAB\_FR1\_A where SAB stands for satellite access band to distinguish from the terrestrial band group naming. **Proposal #2**: The band group for n255 and n266 is termed as: “NR\_FDD\_SAB\_FR1\_A” * + where SAB stands for satellite access band to distinguish from the terrestrial band group naming.
 |

**Issue 1: Capability on the number of Measurement Carriers/Cells/SSBs**

**Proposals**

* Proposal 1: Huawei (R4-2213520)
	+ Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO

**Moderator’s suggestion**

* Agree on Proposal 1, and fill in the following with exact wording (please also clarify the relationship with FG 25-5):
	+ Feature group
	+ Component
	+ Need for the gNB to know if the feature is supported
	+ Consequence if the feature is not supported by the UE
	+ Type

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Support Proposal 1.Type: per-band (not much different from FG#25-2 “Parallel measurements on multiple NGSO satellites within a SMTC” which is defined as “per-band”) |
| MTK | In last meeting, RAN4 has introduced the UE capability as :

|  |  |
| --- | --- |
| 25-5 | Parallel measurements on multiple NGSO satellites within a SMTC |

 Should this capability also applicable here? Then we may no need to introduce a new UE capability. |

**Issue 2: Cell selection and reselection**

**Proposals**

* Proposal 1: Huawei (R4-2213520)
	+ Send LS to ask RAN2 to introduce a new signalling for enabling enhancement cell reselection measurement for LEO

**Moderator’s suggestion**

* Agree on Proposal 1. A draft of LS can be found in the Annex of R4-2213520.
	+ Detailed signalling design is up to RAN2.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | Support proposal 1 and agree to send LS. |
| LGE | Support Proposal 1. |
| MTK | OK |

**Issue 3. SMTC collision condition**

**Proposals**

* Proposal 1: Apple (R4-2211849)
	+ For SMTC inside MG and SMTC outside MG, as long as the proximity distance between MG and SMTC outside MG are less than the proximity distance threshold, SMTC inside MG and SMTC outside MG are considered as colliding case.

**Moderator’s suggestion**

* Based on Proposal 1, agree on the following proposal.
	+ For the case where one SMTC is inside MG and the other SMTC is outside the MG, if the proximity distance between the MG and SMTC outside the MG is smaller than or equal to the proximity distance threshold, i.e. 4ms, the two SMTCs are considered as colliding SMTCs.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with the moderator’s suggestion. |
| Xiaomi | Fine with moderator’s proposal |
| LGE | Support moderator’s suggestion |
| MTK | Fine with Moderator’s suggestion  |

**Issue 4. Fully Overlapping Concurrent MGs**

Agreements (from RAN4#103)

* For non-fully overlapped case: Priority rule applied
* FFS how to address concurrent MGs fully overlapped cases in maintenance phase

**Proposals**

* Proposal 1: Apple (R4-2211849), Xiaomi (R4-2211957), Ericsson (R4-2213355)
	+ For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2
* Proposal 2: Huawei (R4-2213520)
	+ Do not define requirements for fully overlapping concurrent MGs

**Moderator’s suggestion**

* Further discussion

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Although we do not buy all observations provided by the proponents, Proposal 1 is acceptable, and we would like to add the following details for completeness and UE implementation flexibility:* It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 160ms.
	+ Reasoning: we do not see much reason to consider the scenario of fully-colliding MGs when MGRP is less than 160ms.
* A MG with the lowest ID, i.e. 0, gets priority over the other, and the dropping rule starts from SFN=0, i.e. MG-ID#0 is selected and MG-ID#1 is dropped at the first collision instance after SFN=0, and it alternates afterwards.
	+ Reasoning: UE and NW shall be in-sync in terms of dropping rule so that available slots can be used for data reception and transmission.
* RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
	+ Reasoning: It shouldn’t be propagated to TN scenario.
 |
| Xiaomi | Support option 1, fully overlapping case is a typical scenario and it is beneficial to used sharing rule instead of priority rule. As shown in following figure, the MGL for both MG is 6ms and if one of the MGRP is 20ms, the MG with larger MGRP would be fully overlapped. And we don’t think configure a larger MGRP is a reasonable solution, as larger MGRP would cause a much longer measurement delay considering UE measurement capability on number of LEOs. And in NTN case, the longer measurement delay would cause the measurement results invalid. |
| LGE | We prefer option 2, but we are open to sharing factor for only fully overlapping case. For further clarification of multiple MG configuration in NTN, based on MG enhancement WI in Rel-17, two MGs are configured with different priorities, so in NTN MG configuration, we think that different priorities for two MGs would be set. For fully overlapping concurrent MGs, is the same priority for two MGs allowed? If yes, RAN4 should capture MG priority configuration rule in the spec, e.g., the same priority for two MGs is only allowed if two MGs are fully overlapped, otherwise different priority for two MGs should be configured. |
| MTK | We can support Proposal 1. No harm to define requirement for this case.  |

**Issue 5. Maximum interruption in paging reception**

**Proposals**

* Proposal 1: Huawei (R4-2213518)
	+ Remove the requirements for unknown case for paging interruption

**Moderator’s suggestion**

* Agree on Proposal 1.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | This requirement is defined the maximum interruption in paging reception during cell reselection procedure, and in my understanding, the unknown case can be considered as the cell reselection on a new detectable cell. If the requirement for unknown case is removed, the interruption in paging reception during cell reselection on a new detectable cell cannot be guaranteed. |
|  MTK | Support Proposal 1 but we need to clarify the longer interruption is expected if the time span between SIB broadcasting cell stop time and the cell stop time is longer than Ttrigger (i.e. the unknown case)  |

**Issue 6. Re-establishment**

**Proposals**

* Proposal 1: Huawei (R4-2213518)
	+ Define NTN re-establishment requirements as in Table 1 and Table 2.

|  |  |  |
| --- | --- | --- |
| **Serving cell**  | **FR of target NR**  | **Tidentify\_intra\_NR [ms]** |
| **SSB Ês/Iot (dB)** | **cell** | **Known NR cell** | **Unknown NR cell** |
| ≥ -8 | FR1 | MAX (200 ms, 5 x TSMTC) | Kmulti\_SMTC \* MAX (800 ms, 10 x TSMTC) |
| < -8 | FR1 | N/A | [6400]Note1 |
| Note 1: The UE is not required to successfullyidentify a cell on any NR frequency layer when TSMTC > 20 ms and serving cell SSB Ês/Iot < -8 dB.Note 2: Kmulti\_SMTC is defined in clause 9.2C.5.1. |

**Table 2: NTN re-establishment requirements for inter-frequency**

|  |  |  |
| --- | --- | --- |
| **Serving cell SSB Ês/Iot (dB)** | **FR of target NR cell** | **Tidentify\_inter\_NR, I [ms]** |
|  |  | **Known NR cell** | **Unknown NR cell** |
| ≥ -8 | FR1 | MAX (200 ms, 6 x TSMTC, i) | K\_satellite \* MAX (800 ms, 13 x TSMTC, i) |
| < -8 | FR1 | N/A | [6400]Note1 |
| Note 1: The UE is not required to successfully identify a cell on any NR frequency layer when TSMTC,i > 20 ms and serving cell SSB Ês/Iot < -8 dB.Note 2: K\_satellite is defined in clause 9.3C.4. |

**Moderator’s suggestion**

* Agree on Proposal 1.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | Fine with proposal 1 |
|  MTK | Fine with Proposal 1.  |

**Issue 7. RRC Connection Release with Redirection**

**Proposals**

* Proposal 1: Huawei (R4-2213518)
	+ Define NTN re-direction requirements as below.

|  |  |
| --- | --- |
| **FR of target NR cell** | **Tidentify-NR** |
| FR1 | K\_satellite \* MAX (680 ms, 11 x Trs) |
| Note 1: If the UE has been provided with higher layer signaling of *smtc2*specified in TS 38.331 [2] prior to the redirection command, Trs follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.Note 2: K\_satellite is defined in clause 9.3C.4. |

**Moderator’s suggestion**

* Agree on Proposal 1.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | Fine with proposal 1 |
|  MTK | Fine with Proposal 1.  |

**Issue 8. UE Uplink Timing Requirements**

**Proposals**

* Proposal 1: Nokia (R4-2212865)
	+ Modify the requirements such that the reference for (*N*TA *+ N*TA-offset *+ N*TA,common *+ N*TA,UE-specific)*×*Tc accounts for updates in *N*TA,commonand *N*TA,UE-specific
* Proposal 2: Nokia (R4-2212865)
	+ RAN4 to decide what is the reference point in time for updated values of *N*TA,commonand *N*TA,UE-specific:
		- Option 1: The beginning of a DL frame at the UE side.
* Proposal 3: Nokia (R4-2212865)
	+ Include the requirements for the validity timer in the specifications.
* Proposal 4: Nokia (R4-2212865)
	+ Introduce requirements for *N*TA,common and *N*TA,UE-specific

**Moderator’s suggestion**

* Further discussion on each proposal.
* To Nokia: In order to facilitate more efficient technical discussion and decision-making, please provide more detailed/precise wording.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Please provide a little more exact wording. |
| Xiaomi | Regarding proposal 1, the time reference is defined as (*N*TA *+ N*TA-offset *+ N*TA,common *+ N*TA,UE-specific)*×*Tc, and the value of *N*TA,commonand *N*TA,UE-specific is time variation according to RAN1 sepc. No need to have further clarification and modification. |
|  MTK | On Proposal 1, not very clear on how to modify.On proposal 2, in our understanding, the reference time for ***N*TA,common and *N*TA,UE-specific**  in UE transmit timing requirement is the downlink timing, as specified in the current 7.1C.2, i.e. the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell.  |

**Issue 9. Service Link Distance**

**Proposals**

* Proposal 1: Nokia (R4-2212864)
	+ RAN4 to discuss and specify requirements for the measurement of distance between the UE and the SAN for RRM purposes
	+ The satellite ephemeris information to be updated for calculating the distance between the UE and the SAN at [the beginning of every SFN]
	+ RAN4 to discuss if the UE may use satellite information for mobility (handover and cell reselection purposes) even if there is no running validity timer at the UE side

**Moderator’s suggestion**

* Further discussion on the proposal.
* To Nokia: In order to facilitate more efficient technical discussion and decision-making, please provide more detailed/precise wording. Please also clarify if the last bullet of the proposal is in line with all of the agreements made in RAN1/2/4.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We do not fully get the point of the last bullet of Proposal 1, particularly on “no running validity timer at the UE side.” |
| Xiaomi | RAN4 was agreed that RRM requirements and test cases are applied only when NTN ephemeris validity timer is running in WF (R4-2120310). |
| LGE | If we have correct understanding of the Proposal 1, * for first bullet, we think that we don’t need to specify requirement for evaluating distance between UE and SAN, and it could be verified by other requirements using the distance, e.g., UE specific TA.
* for second bullet, we think it is implementation issue.
* for third bullet, when the validity timer of ephemeris information is outdated, UE assumes that it has lost uplink synchronization and UE is allowed not to perform measurement and reporting. If further clarifications are needed, we can further discuss.
 |
|  MTK | On the 1st bullet, in UL transmit timing requirement Te\_NTN, the distance between the UE and the SAN has been considered for UE pre-compensation for the UE specific TA, with assumed GNSS accuracy of 50 m. Hence, additional requirements are not necessary.  |

**Issue 10. Satellite access band grouping**

**Proposals**

* Proposal 1: Ericsson (R4-2214058)
	+ The satellite access bands n255 and n256 are assigned to same band group for applicability of RRM requirements in TS 38.133. NR\_FDD\_SAB\_FR1\_A where SAB stands for satellite access band to distinguish from the terrestrial band group naming
	+ The band group for n255 and n266 is termed as “NR\_FDD\_SAB\_FR1\_A” where SAB stands for satellite access band to distinguish from the terrestrial band group naming

**Moderator’s suggestion**

* Agree on Proposal 1.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | Fine with proposal 1 |
|  MTK | Fine with Proposal 1.  |

## Summary for 1st round

*TBD*

## Discussion on 2nd round

*TBD*

# draft CRs

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

## Open issues summary and Companies views’ collection for 1st round

*Provide your comments on the listed draft CRs*

|  |  |  |  |
| --- | --- | --- | --- |
| **CRs** | **Company** | **Clauses** | **Comments** |
| R4-2212152 | Intel Corporation | 4.2C.2.2, 4.2C.2.3 | Company A:Xiaomi: fine with this CR, 2152, 2851 and 3522can be mergedLGE: fine with the CR. |
| R4-2212398 | MediaTek inc. | 7.3C.2.2, 9.2C.3.1, 9.2C.3, 9.3C.3 | Company A:Xiaomi: fine with this CR |
| R4-2212851 | Nokia, Nokia Shanghai Bell | 4.2C.2.2, 4.2C.2.3 | Company A:Xiaomi: fine with this CR, 2152, 2851 and 3522can be merged |
| R4-2213521 | Huawei, HiSilicon | 9.2C.5, 9.2C.6 | Company A:Xiaomi: fine with this CR |
| R4-2213522 | Huawei, HiSilicon | 4.2C.2.4, 4.2C.2.X | Company A:Xiaomi: fine with this CR, 2152, 2851 and 3522can be mergedLGE: fine with the CR. |
| R4-2213930 | Apple | 9.5C | Company A:Xiaomi: fine with this CR |
| R4-2211958 | Xiaomi | 8.10C | Company A:Xiaomi: this is CR is to introduce active TCI state switching delay requirement, which is missing in spec. |
| R4-2212212 | LG Electronics Inc. | 3.3 | Company A:Xiaomi: fine with this CR |
| R4-2212853 | Nokia, Nokia Shanghai Bell | 7.3C.2.X, 7.3C.2.Y | Company A:Xiaomi: depends on the conclusion on issue 8 and 9 |
| R4-2212863 | Nokia, Nokia Shanghai Bell | 7.1C, 7.3C | Company A:Xiaomi: depends on the conclusion on issue 8 and 9 |
| R4-2213474 | Huawei, HiSilicon | 7.1C | Company A:Xiaomi: fine with this CR |
| R4-2213519 | Huawei, HiSilicon | 4.2C.2.5, 6.2C.1.2.1, 6.2C.3.2.1 | Company A:Xiaomi: The update for 4.2C.2.5 depends on the conclusion on issue 5. |
| R4-2214059 | Ericsson | 3.5.2A | Company A:Xiaomi: fine with this CR |

## Summary for 1st round

*TBD*

## Discussion on 2nd round

*TBD*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
|  |  |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

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

*TBD*

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