**3GPP TSG-RAN WG4 Meeting #** **104-e R4-2214266**

**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.

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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)

# 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. |
| Huawei | Support P1 based on the following agreement from RAN4#102:* For LEO,
	+ the number of target satellites UE needs to monitor per carrier is 2 including serving LEO satellite
	+ introduce UE capability for the number of target satellites the UE can monitor per carrier including serving LEO satellite, which can be up to [X].
	+ (note) A value of X will be de determined in performance requirement development phase. Candidate values are 4 and 6.

We understand 25-5 is a capability on parallel measurement of multiple LEO within a SMTC, while the proposed capability is on measurement of a larger number of LEO per carrier, and it could happen that UE only supports ‘1’ for 25-5, but can support the proposed capability.We try to provide some wording suggestion below.o Feature group: number of target LEO satellites the UE can monitor per carrier including serving satelliteo Component: support monitoring a larger number of target LEO satellites per carrier including serving satelliteo Need for the gNB to know if the feature is supported: yeso Consequence if the feature is not supported by the UE: the number of target satellites UE needs to monitor per carrier is 2 including serving LEO satelliteo Type: per-band |
| Ericsson | We have preferences in below two fields:* Need for the gNB to know if the feature is supported

Yes* Type

Per band |
| Apple  | Fine with proposal 1 in general. For the capability details, we have question/comment for clarification:1. does this capability only apply for intra-frequency carrier or for both intra-frequency and inter-frequency carrier ?
2. if it’s for both, the wording shall be clearer, e.g., inter-frequency carrier will not have serving satellite:

Feature group: On serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier including serving satelliteOn serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier  |
| CATT | Base on Huawei’s comments, we still don’t understand why current 25-5/25-2 cannot cover the case in proposal. |
| Moderator | **Intermediate Summary for the first round of GTW:**Proposal: Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO* Feature group
	+ The number of target LEO satellites the UE can monitor per carrier including serving satellite
* Component
	+ On serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier including serving satellite
	+ On non-serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier
* Need for the gNB to know if the feature is supported
	+ Yes
* Consequence if the feature is not supported by the UE
	+ The number of target satellites UE needs to monitor per carrier is 2 including serving LEO satellite
* Type
	+ per-band
 |
| CMCC | Generally, we are fine with moderator’s intermediate summary, expect for the wording in ‘Consequence if the feature is not supported by the UE’We think the following wording will be more appropriate:o The number of target satellites UE could monitor per carrier is 2 including serving LEO satellite |
| THALES | Fine with way forward. For the number of target satellites in LEO you can have (potentially) up to 12. |

**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.

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | Support proposal 1 and agree to send LS. |
| LGE | Support Proposal 1. |
| MTK | OK |
| Huawei  | Support Proposal 1. |
| Ericsson | Support Proposal 1 and suggest to add signaling for cell-reselection requirements on GEO in same document. |
| Apple | Fine with proposal 1. |
| CATT | Support Proposal 1.  |
| CMCC | Support Proposal 1. |
| THALES | Yes, sure, we are not opposed. |

**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.

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| **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  |
| Huawei | We need more time to understand the proposal.We have no issue with the analysis in R4-2211849 and the suggested definition, but we are not sure how this definition would impact or be used in the requirements. Could proponent please clarify? |
| Ericsson | We understand the intent, the only question is from use case perspective, is this kind of collision regarded to be collision between SMTC and MG or SMTC collision? We prefer collision between SMTC and MG. |
| Apple | Fine with moderator’s suggestion.To Huawei: if the SMTC inside MG and outside MG are considered as colliding, the same principle of SMTC colliding would be used, i.e., as agreed in previous meeting,Define requirements assuming UE measures in only on one SMTC when SMTCs on the same carrier overlap, i.e. measurement period is scaled if two SMTCs on the same carrier overlap.How to reflect it by using Kmulti\_SMTC, K\_satellite in the spec can be further discussed in the CR. |
| CATT | Fine with moderator’s suggestion. |
| Moderator | **Intermediate Summary for the first round of GTW:**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. |
| CMCC | Fine with Moderator’s suggestion |
| THALES | Fine with WF. |

**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

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| **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.  |
| Huawei  | We support P2 for simplicity but can also accept P1 as a compromise. If RAN4 goes with P1, we think the question raised by LGE should be addressed by RAN4. We are open to further discuss the details raised by QC. |
| Ericsson | Support Proposal 1. |
| Apple | Support proposal 1. We still think fully overlapped case is not a corner case in practical network. Even though fully overlapping concurrent MGs can be somehow avoided by using special MGRP and offset combinations, but that’s a hard limitation on network implementation, which means high priority MG must have larger periodicity with low priority MG if they are somehow partially overlapped (low priority MG can only be used on those non-overlapped occasions).We are open to discuss the points raised by QC, for the alignment between UE and NW on the MG dropping pattern, either a predefined/specified pattern or a configurable pattern can be considered. |
| CATT | Support proposal 1.  |
| Moderator | **Intermediate Summary for the first round of GTW:**Proposal: For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2* It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 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.
* RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
 |
| CMCC | We are fine with the proposal 1 and the first bullet from moderator’s intermediate summary. |
| THALES | Fine with proposal 1, TBD. |

**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.

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| **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)  |
| Huawei  | Support P1.To Xiaomi: the problem with unknown case is that it could be difficult for UE to ensure that it can find a suitable cell for reselection within 3 SMTC periods because UE may need to search over multiple carrier frequencies or with multiple ephemeris information. It is unlike the unknown HO case where the target cell is indicated in the HO command. To MTK: we are fine to clarify that longer interruption can be expected for the unknown case. |
| Ericsson | The unknown case was derived because some Ues may not complete (but shall have started) cell search before expiry of serving cell, e.g. t-service, not a totally unknown cell to be reselected. The interpretation is based on an understanding: “…UE should start to perform intra-frequency, inter-frequency or inter-RAT measurements before the t-Service…’. We understand the intention of the proposal. To cope with the case, we prefer to suggest to define a restricted definition of unknown case, instead removing unknown case. Alternative approach is more general, just to indicate longer paging interruption may occur upon UE cannot complete cell search before expiry of serving cell indicated by t-service.(Update) Alternatively, if it can be assumed that the UE should be able to complete eighbou cell detection after t-service but still keep camping on serving cell without introducing interruption, we understand it’s also rational. If so, the process of reselection is always ready before interruption, i.e. no unknown cell for interruption. In this sense, Proposal 1 can be acceptable directly.  |
| Apple | Fine with proposal 1. We agree the side condition is different for this case from HO, but we have different views on the availability of target cell information: UE still can read SIB19 to get the eighbour NTN cell information via NTN-NeighCellConfig-r17 to prepare for reselection. |
| CATT | Support proposal 1.  |
| Moderator | **Intermediate Summary for the first round of GTW:**Proposal: For the requirement of maximum interruption in paging reception, if the target cell is unknown, a longer interruption can be expected. |
| CMCC | **Ok with proposal 1 with the clarification from moderator.** |
| THALES | Ok, as starting point. |

**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.  |
|  Huawei | Fine with Proposal 1.  |
| Ericsson | We agree Proposal 1 to extend time period scaled by Kmulti\_SMTC/ K\_satellite. |
| Apple | Fine with proposal 1 |
| CATT | Fine with Proposal 1 for >-8 case. For <-8, why 6400? |
| CMCC | Fine with proposal 1. 6400=8\*800, we will be very appreciate if proponents could clarify that why scaling factor 8 is considered here. |
| THALES | Fine with moderator suggestion. |

**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.

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| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Xiaomi | Fine with proposal 1 |
|  MTK | Fine with Proposal 1.  |
|  Huawei | Fine with Proposal 1.  |
| Ericsson | We agree Proposal 1 to extend time period which is scaled by K\_satellite. |
| Apple | Fine with proposal 1 |
| CATT | Fine with proposal 1.  |
| CMCC | OK with proposal 1. |
| THALES | Fine with moderator suggestion. |

**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.

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| --- | --- |
| **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.  |
| Huawei | For proposal 1, we see no need on the definition of reference point for uplink transmit timing.For proposal 2, RAN1 spec has the definition of common TA and UE specific TA. RAN4 spec just refer to RAN1 spec.For proposals 3, do not understand what kind of requirements need to be defined.For proposals 4, RAN4 had achieved the agreement not to define separate requirements for common TA and UE specific TA. |
| Ericsson | Proposal 1: OKProposal 2: Regarding the question of RAN4 to decide what is the reference point in time for updated values of *N*TA,commonand *N*TA,UE-specific , RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version.Proposal 3: OKProposal 4: Regarding the question to introduce requirements for NTA,common and NTA,UE-specific, RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version. |
| Apple | Proposal 1: the *N*TA,commonand *N*TA,UE-specific can be referred to RAN1 definition, we don’t understand what update is needed.Proposal 2: the reference timing to apply *N*TA,commonand *N*TA,UE-specific is the reference DL timing (the reception of the first detected path of the corresponding downlink frame from the reference cell). No change is needed.Proposal 3: don’t understand the proposal. RAN4 has agreed that all NTN RRM requirement is based on the validity timer is running, and validity timer running is a side condition for requirement. The timer accuracy requirement is as same as TN based on previous RAN4 agreement. Proposal 4: RAN4 had agreement before that no specific requirement is defined for *N*TA,commonand *N*TA,UE-specific |
| CATT | Proposal 1: the update for NTA, common is defined in RAN1 spec, we don’t understand what is the modification in proposal 1. Proposal 2: it is defined in RAN1 spec. Proposal 4: Not specify the UE behaviour in invalid timer.  |
| CMCC | P1: the definition for *N*TA,commonand *N*TA,UE-specific is referred to RAN1 spec, we don’t see the need to modify the requirements.P2: we think this is not necessary in core requirements.P3: We share similar view with AppleP4: We don’t support this proposal, since the error has been included in Te\_NTN. |
| THALES | Why modifying something that is already agreed and works? Please also note this may have impacts to other groups; for instance RAN1. |
| Nokia | As suggested by the moderator, we will provide more details to the proposals above. And we hope this time we are providing a more clear description. For proposals 1,2 and 4. Section 7.1C.2 is clear: *“The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus (N*TA *+ N*TA-offset *+ N*TA,common *+ N*TA,UE-specific)*×*Tc.”For evaluation purposes, this tells us what to test for. So, for testing purposes all we need is to convert the equation above in one point in time and compare if the UE is compliant with the requirement. * Downlink timing: *“timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. “ .*

So, once the DL frame is received, it is very clear what point in time this refers to. Let’s go for subtracting the TA components. * *N*TA-offset: It is a constant, defined in TABLE 7.1.2-2. For SA deployments, this corresponds to 25600
* *N*TA: It is assigned by the gNB. Once the UE receives this number, it treats it as a constant, until it receives an updated value. But even when the value is updated by gNB there is a crystal clear definition of the point in time this becomes valid. “UE shall adjust the timing of its uplink transmission timing at time slot n+ k+1 for a timing advance command received in time slot n”

So far there are clear instructions for the UE to subtract this component from the DL timing. Let’s now go for the next two components – introduced for NTN exclusively:* *N*TA,common: As defined in RAN 1 agreements, 38.213 captures how the total time is calculated:

*Using higher-layer ephemeris parameters for a serving satellite, if provided, a UE pre-compensates the two-way transmission delay on the service link based on*$N\_{TA,adj}^{UE}$ *that the UE determines using the serving satellite position and its own position. To pre-compensate the two-way transmission delay between the uplink time synchronization reference point and the serving satellite, the UE determines* $N\_{TA,adj}^{common} $*[4, TS 38.211] based on one-way propagation delay* $Delay\_{common}\left(t\right)$ *that the UE determines as:*$$Delay\_{common}\left(t\right)= \frac{TA\_{Common}}{2}+ \frac{TA\_{CommonDrift}}{2}×\left(t-t\_{epoch}\right)+\frac{TA\_{CommonDriftVariant}}{2}×\left(t-t\_{epoch}\right)^{2} $$*where* $TA\_{Common}$*,* $TA\_{CommonDrift}$*, and* $TA\_{CommonDriftVariant}$ *are respectively provided by ta-Common, ta-CommonDrift, and ta-CommonDriftVariant and* $t\_{epoch}$ *is the epoch time of* $TA\_{Common}$*,* $TA\_{CommonDrift}$*, and* $TA\_{CommonDriftVariant}$ *[12, TS 38.331].* $Delay\_{common}(t)$ *provides a distance at time* $t$ *between the serving satellite and the uplink time synchronization reference point divided by the speed of light. The uplink time synchronization reference point is the point where DL and UL are frame aligned with an offset given by* $N\_{TA,offset}$*.*So, given a time “t”, it is possible to calculate the value of the common delay. We are then instructed to multiply it by 2. But there is no instruction about what the time “t” should be at the UE side. What does the UE plugs into the formula? (Beginning of the frame? Beginning of the subframe? Ever 50 ms? The time where T\_e is exceeded?). If a UE updates $Delay\_{common}\left(t\right)$ in the beginning of the frame and other in the beginning of the subframe, they may end up with different *N*TA,common values. But for testing purposes, only one of them can be true. Which one? That’s all we want to clarify. Also, to leave no space for doubts, we also provide in [R4-2212853] that the conversion from $Delay\_{common}\left(t\right)$ to *N*TA,common should be rounded.* *N*TA,UE-specific lands in a similar case. The UE has access to ephemeris. And from that the UE cculate distance. But at exactly what point in time the UE updates this component for accounting the satellite movements? Again, it could be requested to do so every subframe, or every frame, or else. This changes the reference for what exactly value *N*TA,UE-specific will assume. The final result may vary in one direction or the other. For further clarifications we also provide in [R4-2212853] a reference value for the speed of light (the same from TR38.811), that all UEs shou use to convert from distance to *N*TA,UE-specific, such that all are tested under the same conditions.

In both cases, there are NO written specifications about when the updates take place. So, a UE with a running validity timer may update both infrequently and still claim they are doing it correctly. Further evidence of the existence of this lack of definition is reflected in issue 5.3 in the summary 215 being discussed in RAN4. In special regarding option 3 (CATT)For proposal 3, we just want to capture in the specifications the agreements from RAN1 that a UE with no validity timer running should be prevented from performing any transmission. |

**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.  |
| Huawei  | For the first bullet, we understand the performance of measurement of distance between the UE and the SAN has already been covered by other RRM requirements, e.g. UE Tx timing, and we do not see the need to define additional requirements. For the second bullet, we understand when to read SIB19 to get updated ephemeris is up to UE implementation, and it would be too restrictive to require UE to update every frame. For the third bullet, as Xiaomi mentioned, RAN4 has agreed that the RRM requirements apply only when the ephemeris info for the target satellite is valid.  |
| Ericsson | We suggest avoiding specifying or describing measuring distance between the UE and the SAN in RRM specification. The information, its validity and how it works shall be prerequisite of RRM requirements. Regarding the third bullet, we don’t object to the proposal but expect interpretation with more details.  |
| Apple | Bullet #1, it’s up to the GNSS measurement performance, and no new GNSS related requirement will be introduced in NTN WI.Bullet #2, how often UE will read ephemeris information from SI is up to UE implementation as long as UE can meet the RRM requirement.Bullet #3, RAN4 has agreed that all NTN RRM requirement is based on the validity timer is running |
| CATT | We don’t think GNSS related requirements should be introduced in spec. We think update ephemeris it UE implementation. For third bullet, same view as Xiaomi’s comment.  |
| CMCC | Bullet#1: The distance measurement can be validated in timing test cases.Bullet#2: It is up to UE implementation as long as the RRM requirements can be fulfilled.Bullet#3: Same view with Xiaomi |
| THALES | Could you please clarify why we need a requirement for the measurement of the distance? This should simply be considered as a timing error requirement, why distance? |
| Nokia | We want to clarify that, for cell reselection purposes and handover purposes, there is NO running validity timer for the ephemeris of the target cells. As a matter of fact, validity timer for neighbor cells is being discussed now in RAN2, and it has been the subject of significant discussion and some disagreements in the current first round of review in that RAN Group. Assuming the validity timer exists for synchronization purposes, where very fine granularity is required, its implementation was to ensure UE had a tight update of ephemeris. We are in the opinion, though, that for cell reselection and distance purposes, a less precise estimation of distances might be sufficient, therefore, they should not be tied with any running validity timer. At last, if the RAN4 decides that no accuracy for the distance triggers for cell reselection or handover is to be set, we would hold the opinion that such trigger should not be evaluated in the test cases. |

**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.  |
|  Huawei | Fine with Proposal 1.  |
| Ericsson | Moderator’s suggestion is fine. |
| Apple | Fine with Proposal 1.  |
| CATT | Fine with Proposal 1.  |
| CMCC | Agree with proposal 1. |
| THALES | Agree with proposal 1 and moderator suggestion. |

## Summary for 1st round

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

**Agreement: (from the first round of GTW)**

* Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO
* 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

***Further Discussion in 2nd round:***

Proposal: Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO

* Feature index
	+ 25-7
* Feature group
	+ The number of target LEO satellites the UE can monitor per carrier including serving satellite
* Component
	+ On serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier including serving satellite
	+ On non-serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier
* Need for the gNB to know if the feature is supported
	+ Yes
* Consequence if the feature is not supported by the UE
	+ The number of target satellites UE can monitor per carrier is 2 including serving LEO satellite
* Type
	+ per-band
* Mandatory/Optional
	+ Optional with capability signaling

**Issue 2: Cell selection and reselection**

***Tentative agreement:***

* Send LS to ask RAN2 to introduce a new signalling for enabling enhancement cell reselection measurement for LEO. Detailed signalling design is up to RAN2.
* *Note:*
	+ *Huawei will take the lead on drafting LS based on the draft of LS in the Annex of R4-2213520*
	+ *Please also address Ericsson’s comment “add signaling for cell-reselection requirements on GEO in same document”*

**Issue 3. SMTC collision condition**

**Agreement: (from the first round of GTW)**

* 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.

**Issue 4. Fully Overlapping Concurrent MGs**

***Further Discussion in 2nd round:***

* Option 1: Do not define requirements for fully overlapping concurrent MGs
* Option 2: For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2
	+ Option 2A:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 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.
		- RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
	+ Option 2B:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 160ms.
		- RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
	+ Option 2C:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 160ms.

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

**Agreement: (from the first round of GTW)**

* For the requirement of maximum interruption in paging reception, if the target cell is unknown, a longer interruption can be expected.
	+ Unknown condition means that UE starts measurement but does not complete the measurement before Tservice.

**Issue 6. Re-establishment**

***Tentative agreement:***

* 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. |

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

***Tentative agreement:***

* 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. |

**Issue 8. UE Uplink Timing Requirements**

***Further Discussion in 2nd round:***

* Proposal 1: 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.
	+ Note: Please refer to Nokia’s first round comment if not clear.

**Issue 9. Service Link Distance**

***Conclusion of 1st round:***

* Based on comments from companies, no further discussion is needed.

**Issue 10. Satellite access band grouping**

***Tentative agreement:***

* 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

## Discussion on 2nd round

The 2nd round discussion will be carried out over emails:

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

***Further Discussion in 2nd round: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 1(1/3)”***

Proposal: Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO

* Feature index
	+ 25-7
* Feature group
	+ The number of target LEO satellites the UE can monitor per carrier including serving satellite
* Component
	+ On serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier including serving satellite
	+ On non-serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier
* Need for the gNB to know if the feature is supported
	+ Yes
* Consequence if the feature is not supported by the UE
	+ The number of target satellites UE can monitor per carrier is 2 including serving LEO satellite
* Type
	+ per-band
* Mandatory/Optional
	+ Optional with capability signaling

**[Collection of comments made over the email thread “[104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 1(1/3)”**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | On the candidate values, the candidate value starts from 1, does that intend to allow UE to report on support “1” satellite per carrier, since the UE capability can provide more flexibility? We are also fine with this, but we would like to check it is the common understanding, because in the previous meetings the assumption is UE needs to monitor 2 satellites.The max value is 4 is fine, because we got the agreement as follows:***Agreement in RAN4 103e (R4-2210610):**** UE capability for the number of target satellites the UE can monitor per carrier including serving LEO satellite shall not be larger than 4

@ THALES, could you clarify a bit about 12 LEO satellite?  Is that for “per carrier” or “per UE across different frequency”.

|  |  |
| --- | --- |
| THALES | Fine with way forward. For the number of target satellites in LEO you can have (potentially) up to 12. |

 |
| Moderator | 1’ shouldn’t be included in the set of candidate values. Your point is correct, and that was also what I had in mind. I mistakenly included it.If no concerns is received, the following will be captured in WF and let the moderator of FG know this update.**Issue 1: Capability on the number of Measurement Carriers/Cells/SSBs****Agreement: (from the first round of GTW)*** Introduce UE capability for the number of target satellites the UE can monitor per carrier for LEO

**Agreement: (Further agreement made over email discussion in the second round)*** Feature index
	+ 25-7
* Feature group
	+ The number of target LEO satellites the UE can monitor per carrier including serving satellite
* Component
	+ On serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier including serving satellite
	+ On non-serving carrier, it indicates the number of target LEO satellites the UE can monitor per carrier
* Need for the gNB to know if the feature is supported
	+ Yes
* Consequence if the feature is not supported by the UE
	+ The number of target satellites UE can monitor per carrier is 2 including serving LEO satellite
* Type
	+ per-band
* Note
	+ Candidate values for the number of NGSO satellites are 2,3, or 4.
	+ The value shall be larger than or equal to the reported value on FG 25-5.
* Mandatory/Optional
	+ Optional with capability signaling
 |

**Issue 2: Cell selection and reselection**

***Tentative agreement: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: LS”***

* Send LS to ask RAN2 to introduce a new signalling for enabling enhancement cell reselection measurement for LEO. Detailed signalling design is up to RAN2.
* *Note:*
	+ *Huawei will take the lead on drafting LS based on the draft of LS in the Annex of R4-2213520*
	+ *Please also address Ericsson’s comment “add signaling for cell-reselection requirements on GEO in same document”*

**Issue 4. Fully Overlapping Concurrent MGs**

***Further Discussion in 2nd round: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 4(2/3)”***

* Option 1: Do not define requirements for fully overlapping concurrent MGs
* Option 2: For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2
	+ Option 2A:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 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.
		- RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
	+ Option 2B:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 160ms.
		- RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.
	+ Option 2C:
		- It is applicable only to the case where both of the concurrent MGs have the longest MGRP, i.e. 160ms.

**[Collection of comments made over the email thread “[104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 4(2/3)”**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | We can support Option 2C.  We do not support the specific dropping patterns in Option 2A and thus the UE capability singling seems not necessary if no specific pattern is defined.    |
| Xiaomi | Xiaomi are fine with option 2C, and we do not see the necessity to introduce UE capability to support “fully overlapping concurrent MGs”. |
| OPPO | OPPO are fine option 2C or option 1. For option 2C, as discussed in the 1st round, which gap is dropped at each colliding occasion is totally up to UE implementation. It may be better to clarify that “UE is not expected to transmit or receive any data during the union of MGLs for the fully overlapping MGs” |
| Ericsson | Support Option 2C but we can open to discuss Option 2B if necessary. |
| Apple | Supports option 2C which gives flexibility to UE implementation. |
| LGE | we support option 2C. We are still not clear why the capability is needed. |
| CMCC | CMCC prefer Option 2C. As we commented in GTW, we think the capability is useful only under dropping pattern assumption. However, we think the specific dropping pattern in Option 2A somehow limits the UE implementation. So, Option 2C is preferred. |
| Qualcomm | QC can accept Option 1 and Option 2A.With Option 2C, UE will lose lots of resources that could have been used for traffic reception and transmission. If companies are not quite convinced about a separate UE capability for this, QC can compromise to Option 2A without additional UE capability. |
| Huawei | Huawei can support either of option 1, option 2B and option 2C. |

**Issue 6. Re-establishment**

***Tentative agreement: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: WF”***

* 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. |

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

***Tentative agreement: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: WF”***

* 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. |

**Issue 8. UE Uplink Timing Requirements**

***Further Discussion in 2nd round: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 8(3/3)”***

* Proposal 1: 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.
	+ Note: Please refer to Nokia’s first round comment if not clear.

**[Collection of comments made over the email thread “[104-e][214] NR\_NTN\_solutions\_RRM\_1: Issue 8(3/3)”**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CMCC | If our understanding is correct, this 'reference timing 'issue is discussed from RAN4#101bis-e. In the RAN4#102-e, serveral tentative agreements are achieved,

|  |
| --- |
| Tentative agreement in 2nd round:·         Use the definition agreed in RAN1 for NTA,UE-specific and NTA,common;·         It is the common understanding that the NTA,UE-specific and NTA,common used to determine the reference timing are the estimated values.·         It is the common understanding that the NTA,UE-specific and NTA,common used to determine the reference timing are the ideal values without any estimated error in test design. |
| Skip above tentative agreement, and continue the discussion in performance part. |

In our view, one of the main reason for these tentative agreements is as follows, and we also think this reason is valid:The reference time in core requirement is a reference timing based on UE estimation but not an ideal value, and this reference timing is used by UE itself to determine if it shall perform the gradual timing adjustment or not, e.g., in TN requirement: (from Apple)Now, we are still focusing this issue in the perf part, discussing the reference time used by TE to test whether UE can fulfill the Te\_NTN requirement. Therefore, we think we can continue the discussion in email thread [215], Issue 5-3. |
| Moderator | Thank you Shiyuan for the suggestion,Moving this topic to the other thread of NTN (215) is absolutely okay with us.We have brought up this issue multiple times, and presented our view for clarification as a package in the past RAN4 meetings. Unfortunately, nothing hasn’t gone through yet.If acceptable, we can discuss this in the next meeting together with the following FFS points because they might be highly correlated with each other and we may be able to better understand what this all complicated timing relation would look like.**Issue 1-1: Margin assumption for evaluating measurement accuracy.***Agreements in GTW session:** RAN4 considers propagator model error and timing/frequency error when defining the measurement accuracy.
	+ FFS on the values of propagator model error and timing/frequency error
	+ FFS on the definition of propagator model error

If no objection, I will close this open issue from this email thread. |
| Huawei | The reference point of uplink transmission timing in core requirements shall also be determined based on the ideal DL reception timing and the ideal values of common TA and UE specific TA. However, the actual uplink transmission timing is determined based on the estimated DL reception timing and the estimated values of common TA and UE specific TA. That is the reason why the timing error (Te\_NTN) between the actual uplink transmission timing and the reference point of uplink transmission timing exists.For issue 8, the wording ‘updated values of *N*TA,commonand *N*TA,UE-specific’ is not clear for us. If it is used for determining reference point for uplink timing, it shall be the ideal value. If it is used for determining actual uplink timing, it shall be the estimated values at UE side. |
| Moderator | My understanding of the issue is what should be reference time instances when we define exact values of N\_TA,common and N\_TA,UE-specific which should be written down in test requirement section.  |

**Issue 10. Satellite access band grouping**

***Tentative agreement: “Email Thread: [104-e][214] NR\_NTN\_solutions\_RRM\_1: WF”***

* 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

## Summary for 2nd round

The outcome of the second round is captured in the following WF:

* R4-2214471, ” WF on NR NTN RRM requirements,” Moderator (Qualcomm Incorporated), WG4 Meeting # 104-e

# 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.Ericsson: ok |
| 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 mergedHuawei: the change in 4.2C.2.2 means UE should start neighbour cell measurement at t-Service, but isn’t it conflicting with the existing requirements that UE should measure neighbour cells before t-Service? We are not sure if we missed some point here, so clarification from Nokia would be appreciated. Other changes are fine.Ericsson: The meaning is OK, but the wordings ‘or if the UE is configured with ‘*t-Service*’ [2] at the latest when the time instant ‘*t-service*’ is reached’maybe can be updated. |
| R4-2213521 | Huawei, HiSilicon | 9.2C.5, 9.2C.6 | Company A:Xiaomi: fine with this CREricsson: No issue in content. But, we have a little concern that Klayer1\_measurement may face different interpretation when serving cellApple: can we also add the following agreement in section 9.2C.2, 9.3C.2 in this CR? (sorry I’m not sure which CR would be used eventually to capture this scheduling restriction cap)***Agreement in WF R4-2210610:**** Introduce the following scheduling restriction cap as applicability condition for the requirements
	+ Rel-17 NTN RRM requirements is not applicable when overall overhead ratio due to scheduling restriction caused by all configured SMTCs (e.g. scheduling restriction overhead of all SMTCs in one periodicity / SMTC periodicity) is larger than 75%
 |
| 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.Huawei: To Xiaomi, it seems 3522 is not overlapping with 2152 or 2851. Could you please double check? |
| 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 9Huawei: same comments as issues 8 and 9, no need for these changes.Ericsson: Proposal 1: OKProposal 2: Regarding the question of RAN4 to decide what is the reference point in time for updated values of *N*TA,commonand *N*TA,UE-specific , RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version.Proposal 3: OKProposal 4: Regarding the question to introduce requirements for NTA,common and NTA,UE-specific, RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version.Apple: up to issue 8/9 |
| R4-2212863 | Nokia, Nokia Shanghai Bell | 7.1C, 7.3C | Company A:Xiaomi: depends on the conclusion on issue 8 and 9Huawei: same comments as issues 8 and 9, no need for these changes.Ericsson: OK. There is editorial error in K\_offset formula (period used instead of centered dot for multiplication). Apple: up to issue 8/9 |
| R4-2213474 | Huawei, HiSilicon | 7.1C | Company A:Xiaomi: fine with this CREricsson: For N\_TA\_Commin CR points to TS 38.211. Where in TS 38.211? Another option is to point to TS 38.213 4.3. |
| 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** |
| WF on NR NTN RRM requirements | Qualcomm Incorporated | To capture agreements |
| LS to RAN2 on Network indication for applying enhanced cell reselection requirements | Huawei | To send an LS to RAN2 |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2212152 | Serving cell evaluation and intra-frequency measurements of NTN UE cell reselections | Intel Corporation | To be revised | Xiaomi: fine with this CR, 2152, 2851 and 3522can be merged |
| R4-2212398 | CR on TS38.133 NR NTN RRM requirements | MediaTek inc. | Can be endorsed |  |
| R4-2212851 | CR to TS 38.133: Corrections to cell re-selection for NR UE for satellite access | Nokia, Nokia Shanghai Bell | To be revised | Xiaomi: fine with this CR, 2152, 2851 and 3522can be mergedHuawei: the change in 4.2C.2.2 means UE should start neighbour cell measurement at t-Service, but isn’t it conflicting with the existing requirements that UE should measure neighbour cells before t-Service? We are not sure if we missed some point here, so clarification from Nokia would be appreciated. Other changes are fine.Ericsson: The meaning is OK, but the wordings ‘or if the UE is configured with ‘*t-Service*’ [2] at the latest when the time instant ‘*t-service*’ is reached’maybe can be updated. |
| R4-2213521 | CR on intra-frequency measurement requirements for NTN | Huawei, HiSilicon | To be revised | Ericsson: No issue in content. But, we have a little concern that Klayer1\_measurement may face different interpretation when serving cellApple: can we also add the following agreement in section 9.2C.2, 9.3C.2 in this CR? (sorry I’m not sure which CR would be used eventually to capture this scheduling restriction cap)***Agreement in WF R4-2210610:**** Introduce the following scheduling restriction cap as applicability condition for the requirements
	+ Rel-17 NTN RRM requirements is not applicable when overall overhead ratio due to scheduling restriction caused by all configured SMTCs (e.g. scheduling restriction overhead of all SMTCs in one periodicity / SMTC periodicity) is larger than 75%
 |
| R4-2213522 | CR on cell reselection requirements for NTN | Huawei, HiSilicon | To be revised | Xiaomi: fine with this CR, 2152, 2851 and 3522can be mergedHuawei: To Xiaomi, it seems 3522 is not overlapping with 2152 or 2851. Could you please double check? |
| R4-2213930 | Draft CR on L1-RSRP measurements for Reporting in NTN | Apple | Can be endorsed |  |
| R4-2211958 | CR on active TCI state switching delay | Xiaomi | Can be endorsed |  |
| R4-2212212 | CR on Abbreviations for NTN | LG Electronics Inc. | Can be endorsed |  |
| R4-2212853 | CR to TS 38.133: Adding requirements for timing advance for satellite access  | Nokia, Nokia Shanghai Bell | To be revised | Xiaomi: depends on the conclusion on issue 8 and 9Huawei: same comments as issues 8 and 9, no need for these changes.Ericsson: Proposal 2: Regarding the question of RAN4 to decide what is the reference point in time for updated values of *N*TA,commonand *N*TA,UE-specific , RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version.Proposal 4: Regarding the question to introduce requirements for NTA,common and NTA,UE-specific, RAN1 already have definitions in TS 38.213 4.3. We think it is better to point to them to avoid RAN4 creating its own version.Apple: up to issue 8/9 |
| R4-2212863 | CR to TS 38.133: Corrections to UE transmit timing and timing advance for satellite access  | Nokia, Nokia Shanghai Bell | To be revised | Xiaomi: depends on the conclusion on issue 8 and 9Huawei: same comments as issues 8 and 9, no need for these changes.Ericsson: OK. There is editorial error in K\_offset formula (period used instead of centered dot for multiplication). Apple: up to issue 8/9 |
| R4-2213474 | CR on UE transmit timing requirements for NTN | Huawei, HiSilicon | To be revised | Ericsson: For N\_TA\_Commin CR points to TS 38.211. Where in TS 38.211? Another option is to point to TS 38.213 4.3. |
| R4-2213519 | CR on on other RRM requirements for NTN | Huawei, HiSilicon | To be revised | Xiaomi: The update for 4.2C.2.5 depends on the conclusion on issue 5. |
| R4-2214059 | Satellite access band grouping for RRM requirements in TS 38.133 | Ericsson | Can be endorsed |  |

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

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on NR NTN RRM requirements | Qualcomm Incorporated | To capture agreements |
| LS to RAN2 on Network indication for applying enhanced cell reselection requirements | Huawei | To send an LS to RAN2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Rev of** | **Title** | **Source** | **Recommendation**  |
| R4-2214471 | NA | WF on NR NTN RRM requirements | Qualcomm Incorporated | Approved |
| R4-2214472 | NA | LS to RAN2 on Network indication for applying enhanced cell reselection requirements | Huawei | Approved |
| R4-2214576 | R4-2212152 | Serving cell evaluation and intra-frequency measurements of NTN UE cell reselections | Intel Corporation | Withdrawn |
| R4-2212398 | NA | CR on TS38.133 NR NTN RRM requirements | MediaTek inc. | Endorsed |
| R4-2214600 | R4-2212851 | CR to TS 38.133: Corrections to cell re-selection for NR UE for satellite access | Nokia, Nokia Shanghai Bell | Endorsed |
| R4-2214634 | R4-2213521 | CR on intra-frequency measurement requirements for NTN | Huawei, HiSilicon | Endorsed |
| R4-2214635 | R4-2213522 | CR on cell reselection requirements for NTN | Huawei, HiSilicon | Endorsed |
| R4-2213930 | NA | Draft CR on L1-RSRP measurements for Reporting in NTN | Apple | Endorsed |
| R4-2211958 | NA | CR on active TCI state switching delay | Xiaomi | Endorsed |
| R4-2212212 | NA | CR on Abbreviations for NTN | LG Electronics Inc. | Endorsed |
| R4-2214601 | R4-2212853 | CR to TS 38.133: Adding requirements for timing advance for satellite access  | Nokia, Nokia Shanghai Bell | Noted |
| R4-2214602 | R4-2212863 | CR to TS 38.133: Corrections to UE transmit timing and timing advance for satellite access  | Nokia, Nokia Shanghai Bell | Endorsed |
| R4-2214628 | R4-2213474 | CR on UE transmit timing requirements for NTN | Huawei, HiSilicon | Endorsed |
| R4-2214633 | R4-2213519 | CR on on other RRM requirements for NTN | Huawei, HiSilicon | Endorsed |
| R4-2214059 | NA | Satellite access band grouping for RRM requirements in TS 38.133 | Ericsson | Endorsed |

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