**3GPP TSG-RAN WG4 Meeting # 104bis-e R4-2216912**

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

**Agenda item:** 4.2.8

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary: [104-bis-e][201] NR\_NTN\_solutions\_RRM\_1

**Document for:** Information

# Introduction

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

* *4.2.5 RRM core requirement maintenance [NR\_NTN\_solutions-Core]*
	+ *4.2.5.1 Measurement procedure requirements [NR\_NTN\_solutions-Core]*
	+ *4.2.5.2 Others [NR\_NTN\_solutions-Core]*

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 |
| Ericsson | Ming Li | ming.l.li@ericsson.com |
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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.*

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| R4-2215448 | Xiaomi, CAICT | **Proposal 1: 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.**
 |
| R4-2215391 | CATT | **Proposal: It is proposed that RAN4 do not define requirements for fully overlapping concurrent MGs.** |
| R4-2215603 | Apple | **Proposal 1: 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.**

**Observation: in NTN RRM measurement, even though the SMTC periodicity < MGRP, it can still be a fully overlapping case between SMTC and MG if all the SMTCs meet the proximity distance from MG.****Proposal 2: Specify the following Kp definition for NTN intra-frequency measurement without MG and inter-frequency measurement without MG together with a definition of overlapping between SMTC and MG (based on agreement of proximity between SMTC and MG in RAN4 #104e),**

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| **Kp is the scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal\_SAN / Navailable\_SAN, where Navailable\_SAN and Ntotal\_SAN are calculated as follows:****- For a window W of duration max(SMTC period, MGRP\_max), where** **- If UE supports parallelMeasurementGap-r17 and is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap and/or per-FR measurement gap within the same FR as the SSB frequency layer. Otherwise, MGRP max is the MGRP of configured measurement gap.** **- Starting from the beginning of any SMTC occasion:** **- Ntotal\_SAN is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and****- Navailable\_SAN is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in section 9.1C.8.3.****Kp = 1 when Navailable\_SAN = 0.** |

**Proposal 3: RAN4 to send a follow-up LS to RAN2 for previous LS(R4-2210611) that,** **One frequency layer can be associated to both concurrent measurement gaps with the same gap type for SSB based RRM measurement. RAN4 has no discussion on CSI-RS L3 measurement requirement for NTN in R17.** |
| R4-2215751 | MediaTek inc. | Proposal 1: For fully overlapped case, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2 (Option 2).  |
| R4-2216315 | Huawei, HiSilicon | **Proposal 1: For fully overlapped MG case,** * **If MGRP is 160ms, gap sharing rule is applied during the collided gap occasions, and the scaling factor is 2. [RAN4 introduce a new UE capability supporting “fully overlapping concurrent MGs” which is limited to NTN-only.]**
* **If MGRP is not 160ms, no requirement applies.**
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| R4-2216472 | Nokia, Nokia Shanghai Bell | **Observation: Overruling the priority rule in favor of the scaling factor tries to remove hard limitations on the network side, but imposes another one: the network will not be capable of using the priority rule enhancement for multiple measurement gaps.** **Proposal 1: The priority rule to be adopted in NTN for the case of overlapping measurement gaps as a baseline, in order to not preclude NTN to use one of Rel-17 enhancements.** **Proposal 2: If there is no priority assigned to two overlapping measurement gaps, and if both concurrent measurement gaps are set to the longest MGRP, then the gap sharing rule is applied.**  |
| R4-2216504 | Ericsson | **Proposal 1: We can support Option 2A, and we’re open to other methods which can avoid scheduling resources on collided gap.****Proposal 2: As per UE capability supporting ‘fully overlapping concurrent MGs’, we have concerns on the usage. We suggest postponing the proposal until practical demand for the capability is available.** **Proposal 3: For collision between SMTC and MG:*** **If UE is configured with 2 MGPs all the SMTC and MG occasions collide with each other for each of the configured MGPs, the intra-frequency measurement shall apply sharing rule: only defining sharing ratio or explicitly indication of dropping.**
* **Otherwise, the intra-frequency measurement shall use scaling factor (update from Kp concept) to drop SMTC occasions colliding with MG occasions.**
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| R4-2216312 | Huawei, HiSilicon | **Proposal 1: Update the re-establishment requirements for the case with serving cell Es/Iot is < -8dB:*** **6400ms when LEO are searched on the target frequency, and**
* **800ms when GEO are searched on the target frequency**

**Proposal 2: Remove the requirements for UL spatial relation switch for NTN.** |
| R4-2216467 | Nokia, Nokia Shanghai Bell | **Observation 1: The application of downlink timing reference, NTA-**offset and**NTA is well defined in the timing advance requirements.** **Observation 2: The application of**$N\_{TA,adj}^{common}$**lacks the definition of the expected point of application.****Observation 3: The application of** $N\_{TA,adj}^{UE}$ **lacks the definition of the expected point of application.****Proposal 1: UE must update the values of** $N\_{TA,adj}^{UE}$ **using the ephemeris information and** $N\_{TA,adj}^{common}$ **using the common delay formula at the beginning of every uplink slot.****Proposal 2: RAN 4 to define the requirements for application of the UE autonomous components of the timing advance:*** **Option 1: UE considers the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UL signal reaches the satellite**
* **Option 2: UE does not consider the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UE is updating their values.**
* **Option 3: Asks RAN 1 to clarify the application of these components.**
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**Issue 1. Fully Overlapping Concurrent MGs**

Agreements (from RAN4#104)

* 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.

**Proposals**

* Proposal 1: CATT (R4-2215391)
	+ Do not define requirements for fully overlapping concurrent MGs
* Proposal 2: For fully overlapped case, gap sharing rule is applied during the collided gap occasions only when both of the concurrent MGs have the longest MGRP, i.e. 160ms., and the scaling factor is 2.
	+ Proposal 2A: Xiaomi/CAICT (R4-2215448), Apple (R4-2215603), MediaTek (R4-2215751), Huawei/HiSilicon (R4-2216315), Nokia (R4-2216472)
		- A selection of measurement gap between the two is left to UE implementation, i.e. a union of the two measurement gaps including slots in between the two, if any, is considered as one measurement gap while the UE is not required to perform measurements using the both measurement gaps.
	+ Proposal 2B: Ericsson (R4-2216504)
		- 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.

**Moderator’s suggestion (before 1st round GTW)**

* Further discussion

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| **Company** | **Comments** |
| Qualcomm | We are okay with Proposal 1. And we can support Proposal 2B as a compromise.We originally supported Proposal 1 because supporting “fully overlapping concurrent MGs” is not essential to NTN and it was agreed to not support after an intensive discussion on that from R17 MG enhancement WI. The reason that we changed our position is to address the concern from NW vendors that they are not sure about what NTN deployment would look like. Besides, if “fully overlapping concurrent MGs” is precluded, UE will end up with two MGs with periodicities of 80ms and 160msc, which results in Tput loss due to two MGs every 160ms. If Proposal 2A is adopted, the UE will not be scheduled during the union of the two gaps including the gap between the two MGs, which is even worse that “two MGs with periodicities of 80ms and 160msc” in terms of UE Tput.With this, we can only accept either Proposal 1 or Proposal 2B. |
| Ericsson | At least, we shall get agreements on Proposal 2. Regarding the details of how sharing rule works, we suppose Proposal 2B can mitigate the impact to overall throughput performance since network can schedule symbols within the dropped MGs. We are OK with statement in Proposal 2A. ‘A selection of measurement gap between the two is left to UE implementation’. But we concern the detailed solution: ‘a union of the two measurement gaps including slots in between the two, if any, is considered as one measurement gap while the UE is not required to perform measurements using the both measurement gaps.’ If we understand correctly, the method introduces a practical long MG in which no data reception is allowed between 2 MGs even in case that one of 2 MGs works only. We don’t support it because it’s not identical to ‘A selection of measurement gap between the two is left to UE implementation’ and cause more data interruptions. Given that, we suggest only high level ‘A selection of measurement gap between the two is left to UE implementation’ shall be captured if Proposal 2A is decided.   |
| Xiaomi | Support proposal 2, and we also support the first part of proposal 2A ‘A selection of measurement gap between the two is left to UE implementation’. |

**Issue 2: CSI-RS based L3 measurements**

**Proposals**

* Proposal 1: Apple (R4-2215603)
	+ RAN4 to send a follow-up LS to RAN2 for previous LS(R4-2210611) that,
		- One frequency layer can be associated to both concurrent measurement gaps with the same gap type for SSB based RRM measurement. RAN4 has no discussion on CSI-RS L3 measurement requirement for NTN in R17.

**Moderator’s suggestion (before 1st round GTW)**

* In RAN4#101-bis e-meeting, it was agreed that “CSI-RS based L3 measurements are not applicable in Rel-17” which is captured in Issue 1-7-1 of R4-2202637.
* Agree on Proposal 1 in Principle, and work on the details of LS wording. A draft of LS is prepared in R4-2215605.

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| **Company** | **Comments** |
| Qualcomm | Agree with Proposal 1. |
| Ericson | Agree on Proposal 1. |
| Xiaomi | Fine with proposal 1 |

**Issue 3: Update of Re-establishment requirements for GEO**

**Proposals**

* Proposal 1: Huawei/HiSilicon (R4-2216312)
	+ Update the re-establishment requirements for the case with serving cell Es/Iot is < -8dB
		- 6400ms when LEO are searched on the target frequency
		- 800ms when GEO are searched on the target frequency

**Moderator’s suggestion (before 1st round GTW)**

* Further discussion

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| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Ericsson | Since GEO measurements don’t need complex receptions to deal with LEO’s moving and Doppler issue, it’s reasonable to limit time delay in case of GEO. We’re open to the exact number: 800ms or other. |
| Xiaomi | Fine with proposal 1 |

**Issue 4: UL spatial relation switch requirements**

**Proposals**

* Proposal 1: Huawei/HiSilicon (R4-2216312)
	+ Remove the requirements for UL spatial relation switch for NTN

**Moderator’s suggestion (before 1st round GTW)**

* Agree on Proposal 1.

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| **Company** | **Comments** |
| Qualcomm | Agree with Proposal 1. |
| Ericsson | Agree on Proposal 1 |
| Xiaomi | Agree with Proposal 1. |

**Issue 5: Measurement period scaling due to proximity between SMTC and MG**

**Proposals**

* Proposal 1: Apple (R4-2215603)
	+ Specify the following Kp definition for NTN intra-frequency measurement without MG and inter-frequency measurement without MG together with a definition of overlapping between SMTC and MG (based on agreement of proximity between SMTC and MG in RAN4 #104e)
		- Kp is the scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal\_SAN / Navailable\_SAN, where Navailable\_SAN and Ntotal\_SAN are calculated as follows:
			* For a window W of duration max(SMTC period, MGRP\_max), where
				+ If UE supports *parallelMeasurementGap-r17* and is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap and/or per-FR measurement gap within the same FR as the SSB frequency layer. Otherwise, MGRP max is the MGRP of configured measurement gap.
			* Starting from the beginning of any SMTC occasion:
				+ Ntotal\_SAN is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and
				+ Navailable\_SAN is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in section 9.1C.8.3.
		- Kp = 1 when Navailable\_SAN = 0.
* Proposal 2: Ericsson (R4-2216504)
	+ For collision between SMTC and MG:
		- If UE is configured with 2 MGPs all the SMTC and MG occasions collide with each other for each of the configured MGPs, the intra-frequency measurement shall apply sharing rule: only defining sharing ratio or explicitly indication of dropping.
		- Otherwise, the intra-frequency measurement shall use scaling factor (update from Kp concept) to drop SMTC occasions colliding with MG occasions.

**Moderator’s suggestion (before 1st round GTW)**

* Further discussion.

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| **Company** | **Comments** |
| Qualcomm | Okay with Proposal 1. |
| Ericsson | We tried to analyze two possible cases of the issue:Case1: For the case that there still are SMTC occasions which don’t meet proximity condition with MGs, Proposal 1 and Proposal 2 are similar, but **the window shall be updated** from ‘duration= max(SMTC period, MGRP\_max), start point is from beginning of any SMTC occasion’ to ‘duration=( 4ms+max(SMTC period, MGRP\_max)+4ms), start point is from (beginning of any SMTC occasion-4ms)’, otherwise, some proximities may be missed (**Some examples are illustrated in R4-2216504).**Case2: For the case that all SMTC occasions meet proximity condition with MGs, Kp can work same as proposal 1 theoretically. But we worry a bit that the Kp implementation may cause less of chance to measure intra-frequency SMTC since Kp=1 means sharing between intra-frequency and all inter-frequency in MG and wasting symbols resources for unmeasured SMTC occasions which are not totally in MGL in time domain. We suppose there are two options to mitigate aforementioned problem. * 1. Kp=[2].
	2. Explicit dropping rule same to Proposal 2A in issue 1.

The reason is: Option b can bring benefit to throughput performance, but if companies have concerns on Option b with same reason for issue 1, at the least Kp=[2] can reserve enough chance of measurements on intra-frequency. |
| Xiaomi | Fine with option 1 |

## Summary for 1st round

*TBD*

## Discussion on 2nd round

*TBD*

# draft CRs and LSs

*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*

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| **CRs** | **Company** | **Clauses** |
| R4-2215500 | CMCC | 4.2C.2.2 Measurement and evaluation of serving cell4.2C.2.3 Measurements of intra-frequency NR cells |
| **Comments**Company A: |
| R4-2215604 | Apple | 9.2C.5 Intrafrequency measurements without measurement gaps9.3C.7 Inter frequency measurements without measurement gaps |
| **Comments**Company A: |
| R4-2215749 | Samsung | 9.2C NR intra-frequency measurements for SAN |
|  |
| R4-2216316 | Huawei, HiSilicon | 8.1C Radio Link Monitoring for Satellite Access8.5C Link Recovery Procedures for Satellite Access |
| **Comments**Ericsson: It may be impacted by issue 5. |
| R4-2216317 | Huawei, HiSilicon | 9.1C.8 Concurrent measurement gaps for SAN |
| **Comments**Ericsson: the sentence‘No measurement gap occasion is dropped.’is a bit redundant. It doesn’t impact interpretation if we delete the sentence. |
| R4-2216463 | Nokia, Nokia Shanghai Bell | 4.2C.2.4 Measurements of inter-frequency NR cells |
| **Comments**Company A: |
| R4-2216502 | Ericsson | 9.1C.9 Collision between SMTC and MG for SAN9.2C.5.1 Intrafrequency cell identification9.2C.6 Intra-frequency measurements with measurement gaps9.3C.4 Inter-frequency measurement with measurement gaps9.3C.5 Inter-frequency measurements9.3C.7.1 Inter frequency Cell identification |
| **Comments**Company A: |
| R4-2215395 | CATT | 6.1C.1 NR SAN Handover6.1C.2 NR SAN Conditional Handover |
| **Comments**Company A: |
| R4-2215431 | CATT | 4.2C Cell Re-selection for NR UE for Satellite Access4.3C Minimization of Drive Tests (MDT) for Satellite Access5.3C Minimization of Drive Tests (MDT) for Satellite Access7.1C UE transmit timing for Satellite Access7.2C UE timer accuracy for satellite access7.3C Timing advance for satellite access |
| **Comments**Company A: |
| R4-2215582 | Apple | 9.2C.5.3.2 Scheduling availability of UE performing measurements on a neighbor cell served by a different satellite in LEO |
| **Comments**Company A: |
| R4-2215748 | Samsung | 4.2C.2.3 Measurements of intra-frequency NR cells |
| **Comments**Company A: |
| R4-2216313 | Huawei, HiSilicon | 6.2C RRC Connection Mobility Control for Satellite Access |
| **Comments**Company A: |
| R4-2216314 | Huawei, HiSilicon | 8.12C Uplink spatial relation switch delay for satellite access |
| **Comments**Company A: |
| R4-2216464 | Nokia, Nokia Shanghai Bell | File is Empty (No discussion) |
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| R4-2216592 | Nokia, Nokia Shanghai Bell | 6.1C.1.2.1 Handover delay |
| **Comments**Company A: |

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| **LSs** | **Company** | **To** | **Title** |
| R4-2215605 | Apple | RAN2 | Reply LS on measurement gap enhancements for NTN |
| **Comments**Company A: |

## Summary for 1st round

*TBD*

## Discussion on 2nd round

*TBD*

# Recommendations for Tdocs

## 1st round

**New tdocs**

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**Existing tdocs**

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