**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]*

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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’. |
| Apple | Support proposal 2, and we also think the ‘A selection of measurement gap between the two is left to UE implementation’ in proposal 2A is sufficient for requirement design. |
| LGE | We support proposal 2A as UE implementation.  |
| Huawei  | We support option 1 for MGRP < 160ms and support option 2A for MGRP = 160ms. One comment on option 2A, we understand the slots in between two colliding MGs, if any, should be still use-able for data scheduling, so suggest the following update: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. |
| CMCC | We support Proposal 2 [and the first part in Proposal 2A]. Proposal 2B somehow limit the UE behavior. |
| OPPO | Support proposal 2A, the selection between gaps should be up to UE implementation. |
| MTK | We are fine to capture ‘A selection of measurement gap between the two is left to UE implementation’ in the spec.And we also think it needs to clarify the case of "fully overlapped and concurrent MGs have MGRP<=160ms", does the priority rule still apply or it means no requirement? We support no requirement (Option 1).  |
| Nokia | As we propose in our document, we don’t want to risk having the “priority rule” made unusable for NTN. We propose that, we first adopt the priority rule. Then, if the concurrent MGs have the same priority level or if the priority levels are not assigned, then we favor the use of the gap sharing rule. In this case we would prefer option 2A. |
| CATT | Support option 1. In our understanding, proposal 1 seems the same as the high level statement “A selection of measurement gap between the two is left to UE implementation”. But the detailed solution in proposal 2A is not reasonable.  |

**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 |
| Apple | Support proposal 1. |
| LGE | Fine with proposal 1. |
| Huawei  | Fine with P1. |
| CMCC | Support Moderator’s suggestion. |
| OPPO | Support proposal 1. |
| MTK | Agree with Proposal 1. |
| CATT | Fine with moderator’s suggestion.  |

**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 |
| Apple | Fine with proposal 1. |
| Huawei  | Support P1.  |
| CMCC | We support the Proposal 1 |
| OPPO | Support proposal 1. |
| MTK | Fine with Proposal 1. |
| Nokia | The scaling factor of 8 seems too large. The reasoning provided in R4-2216312 is that “NW can broadcast ephemeris for up to 8 satellites with ntn-NeighCellConfigList and ntn-NeighCellConfigListExt in SIB19. However, the scaling factor should be applied only when LEO are searched on the target frequency.”However, ntn-NeighCellConfigList is a list of neighbor cells, not necessarily 8 satellites. Each cell belongs is assigned to one frequency. There seems to be no need to scale both the intra and the inter frequency identification times by 8. Moreover, some UEs may be capable of reading more than on satellite at a given point in time. We think that it may be more agreeable if the delay is scaled by the number of target cells in ntn-NeighCellConfigList if they are provided. |
| CATT | 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. |
| Apple | Fine with proposal 1. |
| LGE  | Fine with moderator’s suggestion |
| Huawei  | Support P1.  |
| CMCC | We support the Proposal 1. |
| OPPO | Support proposal 1. |
| MTK | Agree with Proposal 1. |
| Nokia | Agree with Proposal 1.  |
| CATT | Fine 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 |
| Apple | Support option 1. The scaling factor shall take into account the actual overlapped SMTC and non-overlapped SMTC with proximity. For case 1: we don’t fully understand the justification to extend the window duration, because in our view as long as proximity rule is checked between each SMTC and its closest MG, it will have no issue. Every SMTC within this window will be checked if it’s overlapped SMTC or not, even though some SMTCs may be within the proximity distance from MG at the end of the last window. Moreover, Kp or Kgap is applied to MGRP/SMTC periodicity for intra-freq and inter-freq measurement requirement, which shall be as same as window duration. But we are open to further discuss it.For case 2: We think the issue raised by Ericsson is valid that network may be unaware of which overlapped SMTC is dropped and which MG is not used, but this is same as legacy fully overlapped case between gapless SMTC and MG, no any spec impact is captured in the current requirement. We are open to further discuss it. |
| Huawei  | On P1, we support to update the definition of Kp to consider multiple MGs. However, we understand the agreement on Issue 3 in R4-2214471 from last meeting is for “collision between SMTC outside MG and the other SMTC within MG” but not for “collision between SMTC outside MG and MG”.We define proximity condition for SMTCs because in NTN we may have more than one SMTCs per MO. However, for collision between SMTC and MG which can already happen in Rel-15, we understand the existing definition from Rel-15 should apply, i.e. an SMTC occasion is colliding with an MG occasion if they are (physically) overlapping in time. On P2, the proposals are based on new definition for “collision between SMTC outside MG and MG”. Same comment as for P1, we understand the existing definition from Rel-15 should apply and we see no reason to have a new definition in NTN. Another comment is that the first bullet in P2 is conflicting with the Rel-15 principle that when all SMTC occasions are colliding with MGs, the measurement should be performed within MG. |
| CMCC | We are fine with proposal 1.  |
| OPPO | Fine with proposal 1. The case 2 raised by Ericsson, when all SMTC occasions meet proximity condition with MGs but are not covered within MGL, seems to be a wrong configuration. We prefer to exclude this case but are also open to other solutions.Besides, we think the corresponding update for CSSF is also needed. In the current requirements, CSSF within gap is used when SMTC is fully overlapped with MG. If the Kp=2 or dropping rule proposed by Ericsson is agreed, there is no need to share the MG between SMTC and other inter-frequency measurements and CSSG outside gap should apply. CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps. |
| MTK | More discussion is needed before we agree on the detailed proposals.  Our understanding on Proposal 1 is to introduce a scaling/sharing factor, but one clarification on "and/or per-FR measurement gap..", do we need to consider per-FR here?  On Proposal 2, we have similar concerns as in Issue 1 to define a explicit dropping rule. Thus, "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" would be a common ground between Proposal 1 and Proposal 2. And we think the modification on the Kp can resolve the “collision between SMTC outside MG and MG”. Last, what's the scenario we need to think about additionally for “collision between SMTC outside MG and the other SMTC within MG”? Some example could help the discussion.  |
| Ericsson | (update)Maybe we can focus on the case ‘Case1: For the case that there still are SMTC occasions which don’t meet proximity condition with MGs, ’ firstly, which has less controversy. To answer Apple’s question and maybe proponents of Proposal 1 also can help to check: * The statement Apple mentioned ‘. Every SMTC within this window will be checked if it’s overlapped SMTC or not, even though some SMTCs may be within the proximity distance from MG at the end of the last window.’,
* In existing Kp definition: ‘Navailable\_SAN is the number of SMTC occasions that are not overlapped with any non-dropped MG occasion within the window W’.

We think Apple’s statement is an alternative solution to update Kp, to count the SMTC occasions within the proximity distance from MG occasions which are not in window W.Given that, both solutions are ok to us:Solution A: Update window, duration=( 4ms+max(SMTC period, MGRP\_max)+4ms), or  Solution B: Window duration keeps max(SMTC period, MGRP\_max), but we shall add note that Navailable\_SAN shall not contain the SMTCs within the proximity distance from MG which are outside window.To us, statement in Solution A is clearer. Back to Case 2, ‘For the case that all SMTC occasions meet proximity condition with MGs’.We understand the existing principle ‘if SMTC is colliding with MG, then SMTC measurement shall be performed in MG, i.e. Kp=1’ can be used here. Previously, collision only considered SMTC falling in MGL in time domain, either SMTC is measured or not, only MGL duration cannot be used for scheduling. In NTN, since satellites are moving, SMTC may meet proximity condition with MG, but not fall in MGL in time domain, if existing principle applies, i.e. Kp=1, it causes more wasted scheduling resources because the resources for SMTC outside MG cannot be used in scheduling even when the SMTC is not measured with measurement ratio: CSSFwithin\_gap,i.The motivation of Kp=[2] is to reserve more measurement chance to intra-frequency SMTC, it mitigates wasting resources to some extent. |
| Nokia | We think more discussion (and some clarification, as raised by other companies) is still needed before the proposals can be agreeable. The window of time proposed by Apple seems reasonable at a first glance. But we need to better evaluate the impacts of performing the gap sharing. We are discussing on issue 1, the possibility to adopt a MG rule between fully concurrent MGs. In the worst case scenario, fully concurrent measurement gaps might infringe the proximity rule. In this case the Kp=2 adopted in issue would not be sufficient. We need to consider the interplay between the definitions.  |
| CATT | Fine with proposal 1 to update the definition of Kp. But per-FR gap is not considered in R17.  |
| Apple2 | Thanks for all the comments to proposal 1, and we would like to clarify our understanding as following:1. To Huawei’s question, we think the proximity rule applied to SMTC outside MG and MG is not limited to the same MO. Inside the MG, there might be SMTCs for inter-frequency MO, and we also need to check the proximity between this inter-freq SMTC inside MG and intra-freq SMTC outside MG since it’s related with the UE processing complexity(when UE doing post-processing on one SMTC, it may not response to receive/process next SMTC within certain time interval, regardless of those two SMTCs are for same MO or different MOs).
2. To MTK and CATT comment about per-FR MG, our understanding is that the per-FR1 MG shall still be considered for NTN measurement, because in the current TS38.133 section 9.1C.8.2, it was sated as followings. But we are fine to revise the per-FR MG to per-FR1 MGs to avoid ambiguity.

1. To Ericsson, about the window, we slightly prefer solution B, but open to compromise to solution A if majority companies prefer that one.
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## Summary for 1st round

**Issue 1. Fully Overlapping Concurrent MGs**

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

* Proposal 1: CATT, Qualcomm, MTK
	+ 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-1: LGE, OPPO
		- 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 2A-2: Ericsson, Xiaomi, Apple, Huawei, CMCC, MTK
		- A selection of measurement gap between the two is left to UE implementation
		- UE shall conduct receptions and transmissions outside of the selected measurement gap, if scheduled
	+ Proposal 2B: Qualcomm, Ericsson
		- 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.

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

***Tentative agreement:***

* 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 requirements ~~discussion~~ on CSI-RS L3 measurements ~~requirement~~ for NTN in R17.

**Moderator’s suggestion**

* The LS prepared in R4-2215605 will be used as a draft LS with some updates to capture the above tentative agreement, and the following agreement will be captured in the LS as a reference.
	+ 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.

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

***Tentative agreement:***

* Update the re-establishment requirements for the case with serving cell Es/Iot is < -8dB
	+ 800ms when GEO are searched on the target frequency

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

* Update the re-establishment requirements for the case with serving cell Es/Iot is < -8dB
	+ Proposal 1: 6400ms when LEO are searched on the target frequency
	+ Proposal 2: N x 800ms when LEO are searched on the target frequency, where N is the number of target cells in ntn-NeighCellConfigList

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

***Tentative agreement:***

* Remove the requirements for UL spatial relation switch for NTN

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

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

* Proposal 1: Qualcomm, Xiaomi, CMCC
	+ 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~~
	+ ~~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.~~
* Proposal 3: Ericsson
	+ Case1: SMTCs not meeting the proximity condition with MGs
		- 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 within the window W that are not overlapped with any non-dropped MG occasion within the window W or any non-dropped MG occasion within the proximity distance outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in section 9.1C.8.3.

* + Case2: SMTCs meeting the proximity condition with MGs.
		- Option 1: Kp=[2], when Navailable\_SAN = 0.
		- Option 2: Explicit dropping rule same to Proposal 2A in issue 1.

**Moderator’s suggestion**

* Further discuss the issue taking into account the following cases.
	+ Case1: SMTCs not meeting the proximity condition with MGs
	+ Case2: SMTCs meeting the proximity condition with MGs.

**Issue 6: Clarification on Ttrigger**

Issue to be closed in this thread as per the request from Moderator of Thread#202.

The original issue number in Thread#202 is Issue 3-6

**Moderator’s summary from Thread#202**

*All the companies are fine with option 1, however 3 companies think this issue is related to core requirements and suggest this issue should be tread in thread#201.*

*Recommendations for 2nd round:*

* No further discussion in thread [202] in 2nd round.
* If needed, have further discussion in thread [201] in 2nd round.

***Tentative agreement:***

* Adapt Ttrigger formulation to use the values of Tdetect,NR\_Intra and Tdetect,NR\_Inter also considering the cases UE is not using the enhanced parameters for high mobility.
* For Ttrigger applicability replace the condition:
	+ “This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of t-Service is started…”
	+ By
	+ “This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is first acquired by the UE…”

**Issue 7: Configuration of HO aspects for HO TC**

Issue to be discussed in the second round as per the request from Moderator of Thread#202.

The original issue number in Thread#202 is Issue 4-3:

**Moderator’s summary from Thread#202**

*All the companies are fine with option 1, however 3 companies think this issue is related to core requirements and suggest this issue should be tread in thread#201.*

*Recommendations for 2nd round:*

* Have further discussion in thread [201] in 2nd round

**Companies’ comments in the first round from Thread#202**

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| **Company** | **Comments** |
| Qualcomm | We would like to not consider the case where epoch time starts after the processing interval of the HO delay. The test case can be designed in such a way that UE initiates a valid T430 within the processing interval of the HO delay. |
| Huawei | This issue should be discussed in [201] as it is for core requirements.We think the issue is valid, and we need more time to study the possible additional time e.g. to start new T430 timer. |
| CMCC | This issue should be first discussed in Core part.  |
| Ericsson | Is it a proposal for core part or performance part?If it is a core-part issue, we think it is more like a RAN2 issue, how network ensures valid ephemeris information. validity of UL timing before epoch time is an issue under discussion in RAN2. |
| Nokia | We understand why other companies want to specifate this as a core requirement. We are ok in moving the issue to the core part. To Ericsson, we think there are aspects of this problem that are indeed related to RAN2 and it is currently being discussed there. But, the problem spills over RAN4 specifications as it affects the UE interruption time.  |
| CATT | We think no additional time is needed to start and stop T430. And whether to increase HO interruption time due to epoch time should be discussed in core part.  |
| Apple | Suggest to discuss it in core part. Need FFS. |

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

* Proposal:
	+ RAN4 to decide the best way to deal with the additional delay introduced in the HO procedure for NTN caused by the initiation of T430 towards the target cell.
	+ If the UE can initiate a valid T430 within the processing interval of the HO delay, no additional action is needed.
	+ If the epoch time happens after the processing interval of the HO delay, increase HO interruption time.

**Issue 8: Configuration of CHO aspects for CHO TC**

Issue to be discussed in the second round as per the request from Moderator of Thread#202.

The original issue number in Thread#202 is Issue 4-4:

**Moderator’s summary from Thread#202**

*Majority companies think this issue is related to core requirements and suggest to be discussed in thread [201].*

*Recommendations for 2nd round:*

* Have further discussion in thread [201] in 2nd round

**Companies’ comments in the first round from Thread#202**

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| **Company** | **Comments** |
| Qualcomm | A similar same comment with Issue 4-3.To avoid the case where UE needs to re-acquire ephemeris information of the target cell, TE can configure a large value for ntn-UlSyncValidityDuration-r17. |
| Huawei | This issue should be discussed in [201] as it is for core requirements.We think the issue is valid, and we need more time to study the possible additional time e.g. to re-acquire new ephemeris. |
| Ericsson | Same as Issue 4-3. |
| Nokia | Same as above.  |
| CATT | Same as issue 4-3.  |
| Apple | Same comment as to issue 4-3. |

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

* Proposal:
	+ RAN4 to decide the best way to deal with the additional delay introduced in the CHO procedure for NTN caused by the cases where the UE has to wait for the epoch time to be reached or re-acquire a new ephemeris information.
	+ If the UE needs to re-acquire ephemeris information, the handover delay requirements and the time interruption requirements must be extended to account for that.

## 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**Huawei: OK, but suggest to add this to in cl. 4.2C.2.2 to avoid confusion.- M1=2 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second, upon one SMTC- M1=2.5 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second, upon more than one SMTC,- otherwise M1=1.CMCC: To Huawei, ok with your suggestion.Nokia: If the requirement is defined for when more than one SMTC is configured, then it has to be clear to which of the configured SMTC the T\_SMTC corresponds to. For clarity, it might also be important to say “upon more than one SMTC configured at the UE” |
| R4-2215604 | Apple | 9.2C.5 Intrafrequency measurements without measurement gaps9.3C.7 Inter frequency measurements without measurement gaps |
| **Comments**Huawei: please refer to our comments to Issue 5.CATT: as commented in issue 5, per-FR gap is not considered in R17. And also 4ms distance agreed in last meeting is for SMTC collision not for the collision between gap and SMTC. |
| 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.Huawei: To Ericsson, the change is based on existing agreement for Issue 3-1-4A in R4-2210610 in RAN4#103-e. Technically, the CR is for L1 measurement, and we do not see it is related to Issue 5 which is about collision between SMTC and MG, but we may miss some point here, so it would be good if Ericsson can help to point out how the CR could 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.Huawei: To Ericsson, we can see the point and we are fine to remove the concerned sentence. |
| R4-2216463 | Nokia, Nokia Shanghai Bell | 4.2C.2.4 Measurements of inter-frequency NR cells |
| **Comments**Huawei: We do not support the change. The removed sentence is related to the applicability of the requirements which is well aligned with agreement to account for the margin in the test setup. If the sentence is removed, it would be unclear where the margin in the test setup comes from.Nokia: To Huwaei. Thanks for the clarification. We can agree on this point of view, now. But since it is creating a requirement for the test, then we propose to remove the “at least” from the last sentence.  *“If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, or the distance between UE and serving cell reference location is larger than distanceThresh if distanceThresh is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection.* The requirements apply provided that the distance exceeds the *distanceThresh* by Dmargin, where Dmargin is ~~at least~~ 50 m.*”* |
| 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**Huawei: please refer to our comments to Issue 5.CATT: as commented in issue 5, per-FR gap is not considered in R17. |
| R4-2215395 | CATT | 6.1C.1 NR SAN Handover6.1C.2 NR SAN Conditional Handover |
| **Comments**Huawei: on the following change to cl. 6.1C.2.2.2, it is not clear to us why only the cell identification delay without MG would be used. If we look at the TN requirements in cl. 6.1.4.2.2, the measurement time also refers to measurement with MG (*… defined in clause 9.2.5.1 or clause 9.2.6.2*). *For intra-frequency handover, the requirements for identifying a new detectable intra frequency cell measured without Time To Trigger (TTT) and L3 filtering, Tidentify\_intra\_with\_index or Tidentify\_intra\_without\_index, defined in clause 9.2C.5.1 are used.*Other changes are OK.To Huawei: Thanks for the comments. You are right that the clause 9.2C.6.2 is also needed. Revision is needed to add it.  |
| 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**Huawei: OK. Just one small comment on change to Table 7.3C.2.2-1, instead of removing the number for 60kHz SCS, it is better to put ‘N/A’ in the table, to align the way for handling 60kHz in Table 7.1C.2-1.CMCC: During the review, we found that the description ‘provided that UE is GEO’ in clause 4.2C.2.6/7/8 is incorrect. We suggest to modify to ‘provided that target cell’s satellite is GEO’. We think the modification can be merged in this CR.CATT: to Huawei and CMCC, OK with both of your suggestions. |
| 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**LGE: It seems that indentation level is wrong. |
| 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**Nokia: The CR is agreeable provided we can agree on issue 3 (see our comment) |
| R4-2216314 | Huawei, HiSilicon | 8.12C Uplink spatial relation switch delay for satellite access |
| **Comments**Nokia: In principle we could agree with this CR. But if we make the section void, we will not be able to reuse 8.12C in the future for UL spatial relation, even if in FR2 this is implemented. Is this the intent? Can we just say that UL spatial relation requirements do not apply for NTN in FR1? |
| R4-2216464 | Nokia, Nokia Shanghai Bell | File is Empty (No discussion) |
|  |
| R4-2216592 | Nokia, Nokia Shanghai Bell | 6.1C.1.2.1 Handover delay |
| **Comments**CATT: overlapped with our CR R4-2215395. We think there is no need to add “connected to a NR SAN cell” since all the requirements in clause 6.1C are for the case connected with SAN cell and it has been stated in 6.1C.1.2 and 6.1C.2.2. |

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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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| **Title** | **Source** | **Comments** |
| WF on NR NTN RRM requirements | Qualcomm Incorporated | To capture agreements |
| Reply LS to RAN2 on measurement gap enhancements for NTN | Apple | To send a reply LS to RAN2 |

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| **Title** | **Source** | **Comments** |
| WF on NR NTN RRM requirements | Qualcomm Incorporated | To capture agreements |
| Reply LS to RAN2 on measurement gap enhancements for NTN | Apple | To send a reply LS to RAN2 |

**Existing tdocs**

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| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2215500 | CR on correction to cell re-selection requirement for satellite access | CMCC | To be revised | Capture suggestion from Huawei |
| R4-2215604 | CR on intra-frequency and inter-frequency measurement requirement without MG for NTN | Apple | To be revised | Address comments from Huawei |
| R4-2215749 | CR on intra-frequency measurements in NTN | Samsung | Can be endorsed |  |
| R4-2216316 | CR on RLM and BFR requirements for NTN | Huawei, HiSilicon | To be revised | Pending on Ericsson’s response |
| R4-2216317 | CR on MG requirements for NTN | Huawei, HiSilicon | To be revised | Address comments from Ericsson |
| R4-2216463 | CR for Cell Reselection requirements with distance trigger | Nokia, Nokia Shanghai Bell | To be revised | Address comments from Huawei |
| R4-2216502 | CR on intra-frequency measurements for NTN | Ericsson | To be revised | Address comments from Huawei and CATT |
| R4-2215395 | Completing requirements for conditional handover for NTN | CATT | To be revised | Address comments from Huawei |
| R4-2215431 | CR on cell re-selection, MDT and timing requirements for NTN | CATT | To be revised | Address comments from Huawei and CMCC |
| R4-2215582 | CR on scheduling restrictions for L3 measurements in FR1 for NTN | Apple | To be revised | Address comments from LGE |
| R4-2215748 | CR on intra-frequency cell reselection in NTN | Samsung | Can be endorsed |  |
| R4-2216313 | CR on RRC re-establishment requirements for NTN | Huawei, HiSilicon | Can be endorsed |  |
| R4-2216314 | CR on UL spatial relation switch requirements for NTN | Huawei, HiSilicon | To be revised | Address comments from Nokia |
| R4-2216464 | Editorial CR To TS 38.133 Handover requirements | Nokia, Nokia Shanghai Bell | Can be endorsed |  |
| R4-2216592 | Editorial CR To TS 38.133 Handover requirements | Nokia, Nokia Shanghai Bell | To be revised | Address comments from CATT |
| R4-2215605 | Reply LS on measurement gap enhancements for NTN | Apple | To be revised | Update based on Agreement on Issue 2 |

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