**3GPP TSG-RAN WG4 Meeting # 104bis-e R4-22xxxxx**

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

**Agenda item:** 4.2.8

**Source:** Moderator (Qualcomm Incorporated)

**Title:** WF on NR NTN RRM requirements

**Document for:** Approval

# Introduction

*The WF 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]*

# Topic #1: Open Issues

**\_\_\_Issue 1. Fully Overlapping Concurrent MGs**

**Agreement:**

* ~~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, Qualcomm
    - A selection of measurement gap between the two is left to UE implementation
    - UE shall conduct receptions and transmissions outside of the both measurement gaps, if scheduled, i.e. there is no scheduling restriction in the space between the two measurement gaps.
  + ~~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.~~

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| **Company** | **Comments** |
| Qualcomm | We still supports Proposal 1 and 2B.  However, given the situation and companies feedback that Proposal 2A-2 is acceptable, if we read their comments correctly, we can accept Proposal 2A-2.  If Proposal 2A-2 is adopted, a corresponding correction should be made to, e.g. CSSF, because UE may use only one measurement gap, not the two. |
| Apple | We support option 2A-2, even though we think the 2nd sub-bullet in proposal 2A-2 is not very much relevant to the original proposal of MG sharing, we can accept to keep it since anyway UE has to support scheduling outside MG if no scheduling restriction.  Network vendor confirmed there can be such MG fully overlapping configuration, and both proposal 2A-2 and 2B can be solutions to define the MG sharing. We prefer proposal 2A-2 is because it gave UE more implementation flexibility on the measurement, i.e., not have to follow one-after-one round robin. But we think in the whole measurement period, UE still needs to do MG sharing between 2 MGs because the MOs associated with 2MGs shall be completed in a scaled time period. |
| Ericsson | We’re OK with Proposal 2A-2 and 2B. 2B brings benefits to resources utilization. As per majority views, we think Proposal 2A-2 is acceptable also. Even though 2A-2 has issues on wasting resources, sharing always is applied in other cases, e.g. SMTC overlapping. |

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

***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 on CSI-RS L3 measurements for NTN in R17.

**\_\_\_Issue 3: Update of Re-establishment requirements for GEO**

**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
  + N x 800ms when LEO are searched on the target frequency, where N is the number of target cells in ntn-NeighCellConfigList

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| **Company** | **Comments** |
| Ericsson | We’re OK with Proposal 2. |

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

***Agreement:***

* Remove the requirements for UL spatial relation switch for NTN

**\_\_\_Issue 5: Measurement period scaling due to proximity between SMTC and MG**

**Agreement:**

* 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 1A: Apple
  + 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-FR1 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 that are not overlapped with any non-dropped MG occasion within and outside 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
  + 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.

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| **Company** | **Comments** |
| Apple | Based on the 1st round comments from companies, we propose to revise the proposal 1: (1) revise the per-FR MG to per-FR1 MG. (2) the SMTC may overlapped with MG inside or outside window W(e.g., SMTC at beginning of current window overlaps with MG at the end of last window). We think CSSF\_inside\_MG can be used for scaling measurement time when fully-overlapped case happens (Navailable\_SAN = 0), but we are also fine to further investigate Ericsson’s proposal for case 2. Therefore we keep Kp value in a bracket for further confirmation. We suggest to have proposal 1A below:  Proposal 1A:   * 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-FR1 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 that are not overlapped with any non-dropped MG occasion within and outside 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. |

**Issue 6: Clarification on Ttrigger**

***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**

***Agreement***

* 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.

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| **Company** | **Comments** |
| Ericsson | The issue, not directly about HO but about how to deal with epoch time, is under discussion in RAN2.  We suggest FFS on the detailed interruption time needed if T430 is invalid, since no clear conclusion in RAN2.  Meanwhile, to reflect the issue in RRM if necessary, we suggest the wording can be added into 6.1C.2.2.4 like this ‘the HO interruption time is applied provided UE can initiate a valid T430 before end of Interruption time’. |

**\_\_\_Issue 8: Configuration of CHO aspects for CHO TC**

***Agreement***

*The following issue is not going to be discussed in this email thread at least in the current meeting RAN4#104 e-meeting. The issue can be discussed together with Issue 1-1 in the email thread#215 as needed.*

* 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.

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| **Company** | **Comments** |
| Ericsson | We suggest FFS. Only use the proposal in Issue 7 to restrict the existing definition of interruption time |

# References

[1] R4-22xxxxx, “Email discussion summary: [104-bis-e][201] NR\_NTN\_solutions\_RRM\_1,” 3GPP TSG-RAN WG4 Meeting #104bis-e