**3GPP TSG-RAN WG4 Meeting #112 R4-24xxxxx**

**Maastricht, NL, August 19th – 23th, 2024**

**Agenda item:** 5.15.3

**Source:** MediaTek inc.

**Title:** WF for NR\_MG\_enh2

**Document for:** Approval

# Notes

* Tentative agreement: are potential agreement waiting for final approval.
* Agreement: a statement with consensus from all contributing companies.

# Topic #1: Core- and Perf-parts CR handling

## Companies’ contributions summary

### Sub-topic 1-1: Core part CRs handling

**Issue 1-2-1: R4-2411375 [38.133 clause 9.1.2, 9.1.8.1, 9.1.8.2, 9.1.12, 9.1.13] (CATT)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-2: R4-2411430 [38.133 clause 9.1.6] (Apple)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-3: R4-2411487 [38.133 clause 9.1.13] (OPPO)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-4: R4-2411615 [38.133 clause 7.8.2.22] (Xiaomi)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-5: R4-2412030 [38.133 clause 8.2.2.2.19] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-6: R4-2412031 [38.133 clause 8.2.2.2, 9.2.1, 9.2.5, 9.3.1, 9.3.9] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-7: R4-2412032 [38.133 clause 7.8.2.22] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-8: R4-2412424 [38.133 clause 9.1.12, 9.1.13] (CMCC)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-9: R4-2412501 [38.133 clause 9.1.12.3, 9.1.12.4] (E///)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-10: R4-2412502 [38.133 clause 9.1.5.3, 9.1.13.2, 9.1.13.3] (E///)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-11: R4-2412635 [38.133 clause 9.1.12.3, 9.1.12.4, 9.1.12.5 (new)] (Huawei)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-12: R4-2412636 [38.133 clause 9.4.8] (Huawei)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-13: R4-2413309 [38.133 clause 8.19.5.1, 8.19.5.2, 8.19.5.3, 9.1.12.3, 9.1.12.4] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-14: R4-2413310 [38.133 clause 9.1.13.1, 9.1.13.2, 9.1.13.3] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-15: R4-2413463 [38.133 clause 9.1.12.2, 9.1.12.3, 9.1.12.4] (MediaTek)**

* Recommended WF
  + - Check chairman notes.

### Sub-topic 1-2: Performance part CRs handling

**Issue 1-2-1: R4-2411985 [38.133 clause A.6.6.22.2] (CMCC)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-2: R4-2412033 [38.133 clause A.6.6.24.1] (Nokia)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-3: R4-2412637 [38.133 clause A.6.6.22.2, A.7.6.18.1] (Huawei, HiSilicon)**

* Recommended WF
  + - Check chairman notes.

**Issue 1-2-4: R4-2412638 [38.133 clause A.7.6.19.1, A.7.6.19.2] (Huawei, HiSilicon)**

* Recommended WF
  + - Check chairman notes.

# Topic #2: Concurrent gaps with Pre-MG

### Sub-topic 2-1: Collision handling for dynamic collisions

**Issue 2-1-1: [Case 1] - What is the UE behaviour when the UE doesn’t support dynamic collision FG?**

* Background:
  + **Agreement from RAN4#111 meeting:** 
    - ‘For UE not supporting dynamic collision, the MG will be drop if overlapped with Pre-MG, regardless whether Pre-MG (with higher priority) is activated or deactivated, including the case when the MG overlaps with the Pre-MG activation/deactivation procedure.’
* Proposal:
  + Option 1:
    - For UE not supporting dynamic collision for concurrent gap with Pre-MG, the legacy collision and priority rule would apply regardless of the Pre-MG status.
  + Option 1a:
    - Clarify that the requirements for collision handling are same as R17 con-MG
    - Do not define any requirement for collision between pre-MG (de)activation procedure and MG
* **Tentative agreement:**
  + No need to discuss this issue. This issue is closed. Editorial changes can be done in the CR directly.

### Sub-topic 2-2: Others

**Issue 2-2-1: [Case 1] – [New issue] Whether to include the CPP measurement in the applicability gap configurations?**

* Proposal:
  + Option 1: CATT
    - CPP measurement should be introduced to the applicability of gap configurations.
* **Tentative agreement:**
  + CPP measurement should be introduced to the applicability of gap configurations.

# Topic #3: Concurrent gaps with NCSG

### Sub-topic 3-1: Rel-18 UE behavior for deactivated SCell measurements with NCSG

* Agreement from previous meetings:

|  |
| --- |
| **< Agreement >**:   * **New in Rel-18**   + When Type-2 MG and NCSG are both configured, some serving cell MOs may associated to the NCSG and some are not.     - Question 1: What is the expected UE behaviour (assume SMTC partially overlapped with NCSG)       * Option 1: skip gap association, all deactivated Scells are measured within NCSG. (This implies some new rule to override the existing gap association rule)       * Option 2: Still follow the gap association, i.e., (This implies we follow Rel-17 gap association rule)         + Deactivated Scell MO associated with NCSG is measured within NCSG         + Deactivated Scell MO not associated with NCSG is measured outside NCSG     - Question 2: Whether additional UE capability indication is needed |

**Issue 3-1-1: When the UE is configured with Concurrent gaps with NCSG, what is the potential changes to UE behaviour for NCSG upon SCell activation (in Rel-18)**

Background: Agreement from online session:

* For UE configured with one NCSG and one Type 1/2 MG: All deactivated SCells are measured within NCSG, regardless of the reported UE capabilities [and gap association].
  + Further details on the processing delay between NCSG and Type 1/2 MG can be further discussed.
* For UE configured with 2 NCSG, deactivated SCells are measured with NCSG
  + If the association is provided, deactivated SCells are measured with NCSG according to gap association.
  + If the association is not provided, UE is not expected to cause interruption outside the VIL due to measurement on any of the deactivated SCells, and the existing measurement delay requirement does not apply to this case.
* Proposals
  + Option 1: Apple [starting from R17?]
    - Introduce missing processing requirements at transition between intra-frequency measurement with NCSG and intra-frequency measurement with gaps.
      * similar to Pre-MG deactivation/activation, 5ms processing delay can be considered for measurement type transition between intra-frequency measurement with NCSG and intra-frequency measurement with Type 1/2 MG upon SCell deactivation.
  + Option 2: E///, ZTE, HW
    - When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.
* **Tentative agreement:**
  + When UE switches measurement between NCSG and Type 2 MG, no additional processing delay is expected.

# Topic #4: NeedForGap

### Sub-topic 4-1 DRX

**Issue 4-1-1: Misalignment between DRX-on duration and SMTC for NFG measurements**

* Background (agreement):
  + - Interruption ratio requirement not based on DRX-on duration
    - Not define the interruption location

Agreement:

* Interruptions are not allowed during DRX ON duration
  + Exclude the time extended due to drx-inactivityTimer
  + if there is **no SMTC occasion within a time period** starting [4ms] before the starting point of the DRX ON duration and ending [4ms] after the ending point of the DRX ON duration.

**Issue 4-1-2: Aligned DRX-on duration and SMTC for NFG measurements**

* Background (Agreement)
  + Interruption ratio requirement not based on DRX-on duration
  + Not define the interruption location

Ad-hoc Session chair:

* + - this issue is already covered in the next issue 4-1-1.

**Issue 4-1-3: Interruption requirements for Tcycle,i when DRX cycle is configured and aligned with SMTC occasions**

**Ad-hoc session agreement:**

* For DRX, the interruption ratio is defined based on
  + Tcycle,i = DRX cycle x CSSFoutside\_gap,i, for DRX cycle > 320ms
  + Tcycle,i = max (80ms, SMTC period, DRX cycle) x 1.5 x CSSFoutside\_gap,i, for DRX cycle ≤ 320ms

### Sub-topic 4-2 MRDC interruption requirements

**Issue 4-2-1: Interruption requirements in 8.2.2.2.19 apply also for NR-DC, EN-DC, and NE-DC**

* Background:
  + the NFG signalling is used in NR SA only, as shown below:

|  |
| --- |
| **From 38.331**:  – *NeedForGapsInfoNR*  The IE *NeedForGapsInfoNR* indicates whether measurement gap is required for the UE to perform SSB based measurements on an NR target band while NR-DC or NE-DC is not configured. |

Ad-hoc session agreement

* NFG requirements are applicable for NR SA only.

### Sub-topic 4-3 Others in NFG

**Issue 4-3-1: further clarification on the measurement and interruption spec about gap/BWP configurations**

* Proposals
  + Option 1: QC
    - * Do not clarify. RAN4 does not need to further clarify on measurement and interruption requirement in spec. It is already clearly defined in the spec (clause 9.2.1 , 9.3.1)

**Issue 4-3-2: NFG and NCSG capabilities**

* Previous Agreements
  + No need to establish the mapping between UE’s indication for NeedForGaps and NCSG.

Ad-hoc session agreement:

* + No requirements are applied when the two features, NeedForInterruption and NCSG, are enabled/configured for the same UE at the same time.
    - The wording of NeedForInterruptionConfigNR-R18 and NeedForGapNCSG-ConfigNR-R17 to follow the signalling IE.

**Issue 4-3-3: Cross feature support**

* Background (agreement)
  + - Rel-18 requirements for UE supporting NFG and inter-RAT measurements without gap do not apply for FR2-2.

Ad-hoc session agreement:

* Rel-18 requirements for UE supporting NFG and inter-RAT measurements without gap apply for HST for **FR1**.
* Rel-18 requirements for UE supporting NFG and inter-RAT measurements without gap do **not** apply for HST for **FR2**.

### Sub-topic 4-4 UE capabilities

**Issue 4-4-1: Relations between nr-NeedForGap-Reporting-r16 and nr-NeedForInterruptionReport-r18 and UE behaviours**

* Previous agreements

|  |
| --- |
| **Issue 1-1-2: Scenario 2, NR measurements without gaps**  **Tentative agreements**   1. “no-gap” as part of NeedForGapsInfoNR-r16=FALSE means that the UE support measurement without gaps    1. The UE may or may not cause interruption. 2. if UE causes interruptions when performing measurements without gaps:    1. Support early implementation of Rel-18 NeedForInterruption:       1. Optional since R17    2. FFS the UE behavior if the Rel-18 UE does not support NeedForInterruptionNR-r18 |

Agreement:

* + In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.
    - When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.

# Topic #5: Inter-RAT without gaps

### Sub-topic 5-1 Scheduling restriction

**Issue 5-1-1: Scheduling restriction due to mixed numerology for case b-2**

* Proposals
  + Option 1: E///
    - The scheduling restriction shall be defined for inter-RAT LTE measurement case b-2 with mixed numerology, -- serving cell and target MO have mixed SCS and they are in the same band, and UE does not support mixed SCS between serving cell (NR data reception) and target MO (LTE measurement).
  + Option 2: HW
    - Proposal 6: Do not further discuss scheduling restriction due to mixed numerology for Case b-1/2 (current spec is clear).
* Tentative agreement:
  + Do not further discuss scheduling restriction due to mixed numerology for Case b-1/2 (current spec is clear).

**Issue 5-1-2: Scheduling restriction for case b-1**

* Proposals
  + Option 1 : QC
    - No scheduling restriction is applied for UE indicate nogap-noncsg for inter-RAT EUTRAN measurement without gap.
  + Option 2: HW
    - Proposal 6: Do not further discuss scheduling restriction due to mixed numerology for Case b-1/2 (current spec is clear).
* Tentative agreement:
  + Do not further discuss scheduling restriction due to mixed numerology for Case b-1/2 (current spec is clear).

**Issue 5-1-3: Scheduling restrictions and UE capability reporting**

* Proposals
  + Option 1:
    - For case b-1 and b-2, UE shall always report EMW patterns regardless of whether no scheduling restriction is expected due to mix-numerology.
* Tentative agreement:
  + EMW reporting follow the defined FG 32-6:
    - Note: If UE supports 32-4 or 32-5 and UE requires scheduling restriction, UE should support this FG.
  + No need to modify the defined FG 32-6.

### Sub-topic 5-2 Measurement reporting period requirements

**Issue 5-2-1: Overlap between Effective measurement window and SMTC/SSB**

* ***Background***
  + Previous Agreements
    - For case b-2, when EMW is configured overlapped with SMTC/SSB/CSI-RS measurement with scheduling restrictions, inter-RAT LTE measurement will be dropped.
    - For case b-1 and b-2, when EMW is partially overlapped with MG (EMW periodicity < MGRP), the EMW occasion colliding physically with MG will be dropped.

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**Session Chair:** no further online discussion and official adhoc discussion on this issue.

* Tentative agreement:
  + Close this issue.

**Issue 5-2-2: Overlap between Effective measurement window and MG**

* ***Background***
  + Agreements
    - For case b-1 and b-2, when EMW is partially overlapped with MG (EMW periodicity < MGRP), the EMW occasion colliding physically with MG will be dropped.
    - Note: The proximity rule in Rel-17 does not apply in this case.
* Agreement for down-selection: For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is larger than MGRP and all EMW are covered by measurement gaps,
  + ~~Option 1: inter-RAT LTE measurement will be dropped.~~
  + ~~Option 2: No UE behaviour is specified.~~

Agreement:

* For case b-1 and b-2 inter-RAT LTE measurement causing scheduling restriction, when EMW periodicity is larger than MGRP and all EMW are covered by measurement gaps
  + - apply legacy gap-based measurement requirements, i.e. RAN4 requirements should NOT be defined based on EMW.

**Issue 5-2-3: Tinter1 for EMW configuration:**

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
| **EMW Pattern Id** | **EMW Length (EMWL, ms)** | **EMW Repetition Period**  **(EMWRP, ms)** | **Minimum available time for inter-RAT measurements during 480 ms period**  **(Tinter1, ms)** |
| 2 | 2 | 40 | [24] |
| 3 | 2 | 80 | [12] |

* Proposals
  + Option 1: E///
    - When determining UE requirements using Tinter1 for EMW pattern IDs 2, 3, 4, 5, Tinter1 = 60 for gap pattern IDs 2, 4, and Tinter1 = 30 for gap pattern IDs 3 and 5 shall be used.
  + Option 2: QC
    - When determining UE requirements using Tinter1 for EMW IDs 2 and 3, Tinter1 = 60 for EMW ID 2 and Tinter1 = 30 for EMW ID 3 shall be used if EMW dropping rule is not applied specified in clause X. Otherwise, Tinter1 specified in table 2 is applied.
* **Tentative agreement:**
  + To be discussed directly in a CR.

**Issue 5-2-4: Tinter1 without EMW configuration**

* Proposals
  + Option 1: QC
  + For UE can perform inter-RAT LTE measurement without gap and does not require a scheduling restrictions, Tinter1 = 60ms is applied for the inter-RAT LTE measurement without gap.
* **Tentative agreement:**
  + To be discussed directly in a CR.

**Issue 5-2-5: Scaling factor for case a-1: Nfreq definition**

* ***Background***
  + The principles are different between NR MO outside gap and LTE inter-frequency without MG, where all inter-frequency MOs, regardless if they are measured with or without MG, are counted in the same Nfreq.
* Agreement: Total number of inter-frequency LTE and NR MOs
  + Follow the same principle as LTE

### Sub-topic 5-3 UE capabilities

**Issue 5-3-1: case a-1: The issue with UE capability interRAT-NeedForIntrNR-r18**

* Background (agreements)
  + ~~Option 1: Interruptions due to interRAT NR measurements without gaps must be explicitly allowed by the network (via SIB or other means). Send LS to RAN2.~~
* Proposals
  + - Option 2: QC, vivo
    - Do not change current interRAT-NeedforIntrNR-r18 capability design. Not to make reporting of interRAT-NeedForIntrNR-r18 based on NW control. Do not further discuss how to report UE capability interRAT-NeedForIntrNR-r18.
    - Option 3: CMCC
    - interRAT-NeedForIntrNR-r18 capability is based on network request. Send LS to RAN2.
* **Tentative agreement**
  + Do not change current interRAT-NeedforIntrNR-r18 capability design. Not to make reporting of interRAT-NeedForIntrNR-r18 based on NW control. Do not further discuss how to report UE capability interRAT-NeedForIntrNR-r18.

**Issue 5-3-2: Relations between interRAT-NeedForGaps-r16 and interRAT-NeedForIntrNR-r18 and UE behaviours**

* Previous agreements

|  |
| --- |
| **Issue 1-1-1: Scenario 1, LTE – NR inter-RAT measurement**  **Tentative agreements**   1. interRAT-NeedForGaps-r16=FALSE means that the UE support measurement without gaps    1. The UE may or may not cause interruption. 2. if UE causes interruptions when performing measurements without gaps:    1. Support early implementation of Rel-18 NeedForInterruption:       1. Optional since R17    2. FFS mandatory report of the UE capability R18 interRAT-NeedForIntrNR-r18 from Rel-18 UE if the UE reports interRAT-NeedForGaps-r16=FALSE    3. FFS the UE behavior if the Rel-18 UE does not support interRAT-NeedForIntrNR-r18 |

Agreement:

* + In Rel-18, UE is allowed to optionally report Rel-18 NFI capability for both interRAT-NeedForIntrNR-r18 and NeedForInterruptionNR-r18.
    - When a Rel-18 UE only supports Rel-16 NFG capability but not supports Rel-18 NFI capability, the UE’s behaviour is the same as Rel-16 UE.

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