**3GPP TSG-RAN WG4 Meeting # 104-e R4-2214349**

**Electronic Meeting, 15th – 26th August, 2022**

**Agenda item:** 11.17.3

**Source:** Moderator (vivo)

**Title:** WF on RRM requirements for Rel-17 MUSIM gaps

**Document for:** Approval

# Introduction

This is the WF to capture all agreements and open issues in email thread [104-e][238] NR\_DualTxRx at RAN4 #104.

# Topic #1: Work plan

### Sub-topic 1-1

**Issue 1-1-1: Work Plan**

* + Work plan is provided at [R4-2213450](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213450.zip)

*Tentative agreements: Endorse the work plan*

# Topic #2: RRM requirements for Rel-17 MUSIM gaps

### Sub-topic 2-1 General aspects

**Issue 2-1-1: On MUSIM gap patterns**

* Proposals
  + Option 1: All specification work listed in the 2nd item of WI “Define RRM requirements for Rel-17 MUSIM gaps” are based on existing Rel-17 MUSIM gap patterns defined in Table 9.1.10-1 of TS38.133 (Apple Ericsson MTK CMCC Huawei Xiaomi Charter Qualcomm Oppo vivo)
  + Option 2: Keep it open (Nokia)

*Tentative agreements: Based on majority view, suggest to agree option 1*

*Recommendations for 2nd round: Companies check tentative agreement is fine or not at 2nd round*

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**Issue 2-1-2: On MUSIM gap pattern purpose**

* Proposals
  + Option 1: All MUSIM gaps cannot be used by any measurements configured by network A and all network A measurements are carried out outside MUSIM gaps. (Apple MTK CMCC Huawei xiaomi Charter Qualcomm oppo Ericsson vivo Nokia)
    - Option 1a: MUSIM gaps do not fulfil any measurement objectives on network A (Qualcomm)
  + Option 2: it is necessary to discuss whether MUSIM gap patterns can be used for RRM measurement or only used for MUSIM (CMCC)
  + Option 3: Open to option 2 in case that measurements configured by NW-A is fully overlapped with MUSIM gap (oppo)
* *Moderator note: All companies are ok with option 1*

*Tentative agreements: Option 1*

### Sub-topic 2-2 On network A requirements

**Issue 2-2-1: Principle on network A requirements**

* Proposals
  + Option 1: Define the extended measurement period in NW-A due to the collision with MUSIM gap (oppo vivo)
  + Option 2: Introduce new requirements for intra-/inter-frequency and inter-RAT measurements in NW A when the UE is configured with MUSIM gaps (MTK)

Tentative agreement:

* + Topic is covered by following items, no need to discuss here.

**Issue 2-2-2: Scenario where network A requirement can be directly reused**

* Proposals
  + Option 1: when the MUSIM gap neither collides with any ~~Rel-17~~ legacy gap nor collide with any SMTC/SSB or any resources for L1 measurement; or only MUSIM gaps are configured and the MUSIM gap does not collide with any SMTC/SSB or any resources for L1 measurement, network A measurement requirements can be reused. (Apple vivo oppo)
  + Option 2: RAN4 to specify that all the requirements outside MUSIM gaps for Network A are not impacted by the MUSIM operation. (Apple Ericsson oppo Nokia)
  + Option 3: On top of option 1, the impact on UL related requirements/procedure can be added. (CMCC)
  + Option 4: It may be not necessary to have an agreement on scenario in option 1 (Huawei)
  + Option 5: Further clarification on option 2 is needed (MTK Huawei Xiaomi)
  + Option 6: Focus on scenario when network A is impacted (MTK Charter Qualcomm vivo)
* Moderator: Option 1 and 2 may not be exclusive each other. In addition the discussion on this topic maybe not crucial since the focus should be network A requirement being impacted anyway.

*Tentative agreements: No*

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**Issue 2-2-3: Principle on layer 3 measurement requirements after gap collision handling**

* Proposals
  + Option 1: The principle of defining scaling factor Kp and Kgap for multi-concurrent gaps are applied to the calculation of Kp and Kgap for layer 3 measurement (Apple xiaomi oppo MTK vivo)
    - Option 1a: re-use the ‘counting’ approach defined for Rel-17 concurrent MGs to define scaling factor for the impacts of MUSIM gaps (Apple xiaomi vivo)
  + Option 2: Define requirements after solving gap collision issue (CMCC Huawei vivo MTK Qualcomm Nokia)
  + Option 3: Too early to discuss this issue (Ericsson)

*Tentative agreements: No*

*Recommendations for 2nd round: A few companies thin it is too early to discuss this topic and other companies are ok with option 2, which is FFS as well. Suggest stop discussion at 2nd this meeting and continue discussion in future meeting*

**Issue 2-2-4: Principle on L1 measurement requirements after gap collision handling**

* Proposals
  + Option 1: The principle of defining P value for L1 measurement and RLM/BFD measurement in Rel-17 cam be reused (Apple xiaomi oppo)
    - Option 1a: re-use the ‘counting’ approach defined for Rel-17 concurrent MGs to define scaling factor for the impacts of MUSIM gaps (Apple xiaomi oppo)
  + Option 2: Define requirements after solving gap collision issue (CMCC xiaomi vivo Huawei Qualcomm Nokia)
  + Option 3: Too early to discuss this issue (Ericsson)

*Tentative agreements: No*

*Recommendations for 2nd round: A few companies thin it is too early to discuss this topic and other companies are ok with option 2, which is FFS as well. Suggest stop discussion at 2nd this meeting and continue discussion in future meeting*

### Sub-topic 2-3 Gap collision handling

**Issue 2-3-1: General principles on gap collision handling**

* Proposals:
  + - Option 1: For priority based solution, priorities can be allocated to each existing gap patterns and when two or more gap collide, only the highest priority gap is kept and all other gaps are dropped (Apple MTK Huawei Xiaomi oppo vivo)
    - Option 2: Apply gap-group priority to handle collisions between different gaps groups (i.e., MUSIM gaps group and legacy MGs group). Then, within each gap group, apply different priorities to handle the collision between the gaps within the same group (Ericsson MTK Charter)
    - Option 2a: MUSIM gaps can be believed as a gap set with a specific usage and priority within the ConMGs ()
    - Option 3: Agree at high-level that applying priority rule to handle collisions, but the way how to apply it can be FFS (MTK)
    - Option 4: priority-based scheme for (a) Collisions between a MUSIM gap and measurement gaps and (b) Collisions between MUSIM gaps, but the definition of collisions may be different for cases a and b. (Qualcomm)
    - Option 5: FFS (Nokia)

*Tentative agreements: No*

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**Issue 2-3-1-1: On network A priority assignment scheme**

* Proposals:
  + - Option 1: RAN4 to study the issue when the priority is all assigned by NW A, under the current signalling framework, which might lead to missing significant activities in NW B due to MUSIM gap collision handling (e.g., reading the paging in NW B, which are unknown to NW A) (MTK Apple Ericsson Huawei QC oppo vivo)
    - Option 2: Clarification is needed for option 1 (Nokia)

*Tentative agreements: No*

*Recommendations for 2nd round: No more discussion at 2nd round. Since most companies are open for further study on the scenario listed in option 1. It is not necessary to discuss whether to study it or not at 2nd round. Interested companies can bring concrete solution on this issue at next meeting.*

**Issue 2-3-2: Collisions between MUSIM gap and legacy measurement gap (i.e., Rel-15 to Rel-17 measurement gaps)**

**Issue 2-3-2-1: Clarification on the scope of Rel-17 legacy gap**

* Proposals:
  + - Option 1: Discuss if concurrent MUSIM and other Rel17/18 measurement gap types is in the scope of this WID or NR\_MG\_enh2 (Nokia)
    - Option 2: In case 1, gaps to be considered include all gaps defined till Rel-17 including Pre-MG, NCSG and legacy gaps for measurement and other purposes (Ericsson MTK CMCC Huawei vivo xiaomi Qualcomm oppo)
    - Option 3: Concurrent MUSIM and other R17 gaps (but not R18) are in scope (Apple Huawei)

*Tentative agreements: No*

*Recommendations for 2nd round: Suggest to agree option 2. Continue discuss whether concurrent MUSIM in option 3 is in the scope or not.*

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**Issue 2-3-2-2: Collisions handling rules between MUSIM gap and legacy measurement gap**

* Proposals:
  + - Option 1: Priority-based gap collision handling introduced in concurrent gaps design can be used as a base for collisions between MUSIM gap and legacy measurement gap (Charter Apple CMCC Xiaomi oppo Qualcomm vivo Huawei MTK Ericsson Nokia)
    - Option 1a: Request RAN2 to introduce optional signaling so that the UE can request the priority level of MUSIM gaps (relative to measurement gaps) via UAI (Qualcomm)
    - Option 2: Other enhanced gap collision solutions are open for study. (Apple Charter Ericsson CMCC Huawei xiaomi vivo Nokia)
* Moderator: Option 1 and option 2 are not exclusive each other

*Moderator: All companies are ok with option 1 and most companies are open for option 2. Option 1a could be FFS. Moderator think it is not necessary to discuss option 3 and related options (option 4 and 5) any more at 2nd round since no supporting company.*

*Tentative agreements: Agree option 2 and option 1 with the clarification that “legacy measurement gaps” in option 1 includes all measurement gaps is Rel-17.*

*Recommendations for 2nd round: Companies check tentative agreement is fine or not at 2nd round*

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**Issue 2-3-2-3: Priority of MUSIM against other legacy gaps**

* Proposals:
  + - Option 1: MUSIM gaps should have high priority in the event of a collision (Charter Qualcomm)
    - Option 2: MUSIM gaps can be defined as the lowest priority, and periodic MUSIM gaps will be dropped once the gap dropping rule defined in Con-MGs is met (Ericsson)
    - Option 3: Up to NW configuration (Apple MTK CMCC Huawei Xiaomi Charter oppo vivo)
    - Option 4: FFS (Nokia)

*Tentative agreements: No*

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**Issue 2-3-2-4: Order for applying the priority when number of colliding MGs is larger than 2**

* Proposals:
  + - Option 1: For collisions between MUSIM gap and legacy measurement gap (i.e. Rel-15 to Rel-17 measurement gaps), RAN4 to discuss the order for applying the priority when number of colliding MGs is larger than 2. (Huawei)
    - Option 2: The gap with the highest priority is kept when colliding (Apple vivo)
    - Option 3: FFS (Apple Ericsson MTK Huawei xiaomi QC Nokia)

*Tentative agreements: FFS*

*Recommendations for 2nd round: Most companies prefer FFS. No more discussion at 2nd round. Interested companies can bring concrete solution on this issue at next meeting.*

**Issue 2-3-2-5: Definition on MUSIM gap collides with legacy gaps (separated from Issue 2-3-4-1)**

* Proposals:
  + - Option 1: The gap proximity condition of concurrent gap collision could be reused for MUSIM gap collision with other gaps (MTK)
    - Option 2: FFS

*Tentative agreements: Agree option 1*

*Recommendations for 2nd round: Check tentative agreement is fine or not at 2nd round*

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**Issue 2-3-3: Collisions between MUSIM gap and SMTC and other L3/L1 measurement resources**

**Issue 2-3-3-1: Definiton of collisions between MUSIM gap and SMTC and other L3/L1 measurement resources**

* Proposals:
  + - Option 1: Condition “SMTC is overlapping with MUSIM gap“ and “L1 measurement resource is overlapping with MUSIM gap” could be used as baseline for MUSIM gap collision with SMTC an L1 measurement resources (Apple oppo)
    - Option 2: option 1 needs more clarification (Ericsson Nokia)
    - Option 3: “Condition “SMTC is overlapping with MG” and “L1 measurement resource is overlapping with MG”could be used as baseline for MUSIM gap collision with SMTC and L1 measurement resources. (MTK Huawei xiaomi Qualcomm oppo vivo)

*Tentative agreements: suggest to agree updated option 1 based on MTK’s comment as below: “*Condition “SMTC is overlapping with MG” and “L1 measurement resource is overlapping with MG” could be used as baseline for MUSIM gap collision with SMTC and L1 measurement resources.

*Recommendations for 2nd round: Companies check tentative agreement is fine or not at 2nd round*

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**Issue 2-3-3-2: Priority of MUSIM against SMTC, and other L3/ L1 measurement resources**

* Proposals:
  + - Option 1: MUSIM gaps should have high priority against SMTC and L1 measurement resources (xiaomi oppo Qualcomm Huaewi MTK)
    - Option 2: NW-A’s RRM procedure, including DL SMTC should have higher priority than MUSIM gaps. The MUSIM periodic gaps should be dropped once the gap proximity rule is met. (Ericsson)
    - Option 3: As baseline solution, UE can only perform gap-less L3 measurement and L1 operation outside MUSIM gap. Other solutions are not precluded to handle collision between MUSIM gap and SMTC/RS for L1 operation. (Apple)
    - Option 4: FFS (Ericsson Nokia)

*Tentative agreements: No*

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**Issue 2-3-3-3: Priority of MUSIM against uplink signals, such as PRACH, CSI-RS reporting etc.**

* Proposals:
  + - Option 1: NW-A’s RRM procedure, including UL CSI-RS, PRACH, should have higher priority than MUSIM gaps. The MUSIM periodic gaps should be dropped once the gap proximity rule is met. (Ericsson)
    - Option 2: PRACH procedure can be higher priority than MUSIM gaps (MTK)
    - Option 3: FFS (Huawei)

*Tentative agreements: No*

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**Issue 2-3-4: Collisions between different MUSIM gaps**

* Proposals:
  + - Option 1: priority rule can be used as baseline (Apple Charter CMCC Xiaomi oppo vivo Huawei)
    - Option 2: RAN4 will discuss separately how to define and resolve collisions between MUSIM gaps (Qualcomm Huawei)
    - Option 3: To avoid the collision within MUSIM gaps, UE should request a single periodic gap instead of two separate periodic gaps provided that the distance between these two gaps is shorter than 5ms (Ericsson)
    - Option 4: Aperiodic gap should have higher priority than periodic gaps once collision happens within MUSIM gaps. (Ericsson MTK)
    - Option 5: It is UE’s responsibility not to request colliding MUSIM gaps from NW-A (Nokia)
    - Option 6: Option 2 and 4 can be discussed if option 1 is agreed (Charter)
    - Option 7: Option 2 can be discussed if option 1 is agreed (MTK)
    - Option 8: Option 3 is up to implementation and out of scope (MTK Huawei vivo)
    - Option 9: When the time duration between the two closest gap occasions within the two measurement gap patterns is shorter than [4]ms and the second gap occasion is for paging, UE should keep both gap occasions instead of dropping any of them. (Ericsson)

*Tentative agreements: No*

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**Issue 2-3-4-1: On MUSIM gap collision definition**

* Proposals:
  + - Option 1: The gap proximity condition of concurrent gap collision could be reused for MUSIM gap collision (Apple Ericsson Huawei Xiaomi Charter oppo)
    - Option 2: RAN4 should consider different definition/handling of collisions between MUSIM gaps (Qualcomm)
    - Option 3: FFS (Nokia)

*Moderator note: to moderator’s understanding, MUSIM gap collision in option 1 means collision between different MUSIM gaps.*

*Tentative agreements: No.*

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**Issue 2-3-5: On aperiodic gap**

**Issue 2-3-5-1: On aperiodic gap priority**

* Proposals:
  + - Option 1: UE can request aperiodic MUSIM gap with a higher priority. (Ericsson)
    - Option 2: Option 1 is up to UE implementation (oppo vivo)

*Tentative agreements: No*

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**Issue 2-3-5-2: On the time window W for aperiodic gap**

* Proposals:
  + - Option 1: Discuss whether and how to determine the time window W when aperiodic MUSIM gap with higher priority is involved in collision (oppo)
    - Option 2: W could be the largest periodicity among all the periodic gaps + Time margin [M] for the one-shot aperiodic gap (MTK)
    - Option 3: FFS (Huawei Qualcomm vivo)

*Tentative agreements: No*

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### Sub-topic 2-4 Network B requirements

**Issue 2-4-1: Whether to define network B requirements**

* Proposals:
  + - Option 1: Define the requirements for Network B in RRC idle/inactive (xiaomi Ericsson Charter)
    - Option 2: No measurement requirements in network B will be defined by RAN4 (MTK Huawei Qualcomm Nokia vivo oppo)
    - Option 3: No impact on Network B requirements provided that the gaps are configured in Network A. and RAN4 not to change idle/inactive requirements on Network B (Nokia)
    - Option 4: If there is a consensus to specify network B requirement, its priority should be lower compared with the work for network A requirements and could be carried out at the second phase in the WI time frame (Apple xiaomi vivo oppo)
    - Option 5: If requirements for measurements in NW B are to be defined, re-use the existing requirements for IDLE/INACTIVE as baseline with DRX cycle replaced by max(DRX cycle, MGRP) ()
    - Option 6: No new requirements to be introduce for NW B measurements in RRC\_IDLE/\_INACTIVE state, however, further study the impact on NW B measurement requirements considering different scenarios. ()

*Tentative agreements: No*

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**Issue 2-4-2: Scope of network B requirements**

* Proposals:
  + - Option 1: If there is a consensus on defining network B requirements, the following requirements are purposed to be defined for network B idle/inactive state. Requirements are not needed for other “best effort” based functions. (vivo)
    - UE measurement capability
    - Measurement and evaluation of serving cell
    - Measurements of intra-frequency NR cells
    - Measurements of inter-frequency NR cells
    - Measurements of inter-RAT E-UTRAN cells
    - Maximum interruption in paging reception
    - Measurements for UE configured with relaxed measurement criterion
    - Option 2: Depending on issue 2-4-1 and FFS (MTK Huawei vivo Nokia Ericsson)

*Tentative agreements: No*

*Recommendations for 2nd round: Since it* depends on issue 2-4-1, no more discussion at 2nd round

**Issue 2-4-3:Principles on network B requirements**

* Proposals:
  + - Option 1: Define the measurement period in NW-B when MUSIM gap is not dropped, and deprioritize the scenario when MUSIM gap is dropped due to collision (oppo)
    - Option 2: Depending on issue 2-4-1 and FFS (MTK Huawei vivo Nokia Ericsson)

*Tentative agreements: No*

*Recommendations for 2nd round: Since it* depends on issue 2-4-1, no more discussion at 2nd round

### Sub-topic 2-5 Others

**Issue 2-5-1: MUSIM overhead**

* Proposals:
  + - Option 1: RAN4 to define MUSIM gap overhead for MUSIM gap(s) (Xiaomi)
    - Option 2: not necessary to define overhead (Ericsson)
    - Option 3: wait for concurrent gap conclusion (MTK xiaomi oppo)
    - Option 4: FFS (Huawei Qualcomm vivo Nokia)

*Tentative agreements: No*

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**Issue 2-5-2: Conditions in which the UE is allowed to request MUSIM gaps**

* Proposals:
  + - Option 1: RAN4 needs to define the conditions in which the UE is considered to be in MUSIM operation mode (Ericsson Nokia)
    - Option 2: Not necessary (MTK Huawei Qualcomm vivo)

*Tentative agreements: No*

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**Issue 2-5-3: Conflicting bands and band combinations for MUSIM**

* Proposals:
  + - Option 1: Address the MUSIM related RF issue when for the uninterrupted operation a UE should use particular band/carrier combinations for two SIM cards. (Apple)
* Moderator Note: The option is out of the scope however it is ok to collect comments here this meeting. And no official decisions on this issue will be made in this meeting.

*Tentative agreements: No*

*Recommendations for 2nd round: a RF issue, comments have been collection at 1st round and no more discussion at 2nd round.*

**Issue 2-5-4: Power back-off for MUSIM**

* Proposals:
  + - Option 1: Address the MUSIM related RF issue when for the uninterrupted operation a UE should apply power back-off larger than existing MPR/A-MPR limits (Apple)
* Moderator Note: The option is out of the scope however it is ok to collect comments here this meeting. And no official decisions on this issue will be made in this meeting.

*Tentative agreements: No*

*Recommendations for 2nd round: a RF issue, comments have been collection at 1st round and no more discussion at 2nd round.*

**Issue 2-5-5: On the impact of item 1 of WI (simultaneously RRC connected operation)**

* Proposals:
  + - Option 1: RAN4 to start work on simultaneous RRC connected networks once RAN2 have progressed on the topic (Nokia)
* Moderator Note: In [RP-220955] it mentions “The work item shall identify whether the WI (Enhancements for MUSIM procedures to operate in RRC\_CONNECTED state simultaneously in NW A and NW B) will have RAN3 or RAN4 impacts by RAN#99”
* Recommended WF
  + Depending on conclusion of RAN#99 and not necessary to have further discussion (Note: there is no discussion at 1st round)

# Reference