**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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| **Company** | **Comments** |
| Ericsson | Agree option 1. |
| Apple | Support option 1. |
| Nokia | We are fine with tentative agreement |
| Charter | Option 1. |
| CMCC | OK with option 1. |
| Huawei | Support option 1. |
| Qualcomm | Support option 1. |
| Xiaomi | Support option 1. |
| MTK | Support Option 1. |
| vivo | We are fine with tentative agreement |

**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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| **Company** | **Comments** |
| Ericsson | We agree with moderator’s comments.  We suggest to postpone the discussion since this is not a crucial topic and will be easily solved after all controversial overlapping issue agreed. |
| Apple | Options are not completely mutual exclusive to each other. We are also fine to focus on scenario when network A is impacted. |
| OPPO | Agree with moderator’s comments. |
| Nokia | We still think Option 2 would be important for the MUSIM requirements definition.  Agree that Option 1 and 2 are not mutually exclusive.  Is the intention of the moderator to keep all options open? |
| Huawei | Agree with moderator’s comments.  We also suggest to postpone the discussion on this issue and focus on the impacts of MUSIM gaps. |
| Xiaomi | Agree with moderator’s comments. |
| MTK | Agree with moderator’s comments, we should focus on the requirements impacted by MUSIM gaps not the other way around, for which we supported Option 6. |
| vivo | Option 1, 2 and 3 could be further discussed at future meeting. |
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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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| **Company** | **Comments** |
| Ericsson | Option 2.  Compared with option 1, we think option 2 has more benefits and can reuse R17 concurrent gaps agreement as much as possible. For example,   1. Max number of gaps supported in Concurrent gaps   Now at most 2 gaps are supported in concurrent gaps and it seems most of companies suggest to keep this number in R18 MG enh WI. If we believe MUSIM gaps as ‘one gap’, then we don’t need to further discuss this issue here but following Concurrent gaps agreement. Both NW and UE can believe MUSIMs gap as one gap.   1. Issue 2-3-2-4: Order for applying the priority when number of colliding MGs is larger than 2   Now at most 2 gaps are supported in concurrent gaps and no multiple overlapping issues for 2-3-2-4. If we believe MUSIM gaps as ‘one gap’, then we don’t need to further discuss this issue since we still only have two colliding MGs in concurrent gaps.   1. Issue Overhead   RAN4 spent one and a half year to achieve this overhead issue for 2 concurrent gaps. If we believe MUSIM gaps as ‘one gap’, then we don’t need to reopen this issue again in MUSIM gaps.  From NW’s perspective, all MUSIM periodic gaps have no any difference and should apply the same priority. How to handle the UE’s behaviours in each MUSIM gap is a black box and fully up to UE. There is no any further impact except the overall interruption to NW-A. |
| Apple | We support option 1 as baseline and open to further discuss other options. Some response to E///, in our understanding MUSIM gap is not explicitly considered when discussing keeping at most 2 gaps in R18. Besides, we are not sure if all MUSIM periodic gaps must have same priority. Anyway, E/// indeed raised some good points. We are open for further discussion. |
| OPPO | We can compromise to high-level rule in option 3. The definition for gap collision can be discussed in other issues. |
| Nokia | We think this topic needs further discussion in defining the priority schemes and further details. |
| Charter | We support option 2 and we agree with Ericsson, if MUSIM gaps are treated as ‘one gap’, a lot of the agreements in concurrent gaps are applicable here. |
| CMCC | Option 3. In general, we agree that priority rule can be considered, but the details can be FFS. |
| Huawei | We support option 1 as baseline.  On the issues raised by E///, we are open to discuss the number of gaps and the overhead cap considering MUSIM gaps, but it seems a separate discussion from the priority and collision handling. We also agree that the scenario where MUSIM gaps have same priority needs to be considered, but it seems to be a special case of option 1. |
| Qualcomm | Option 4.  We agree that priority rule can be the baseline to resolve collisions between MUSIM gaps and measurement gaps. The details about how to define/apply the priorities can be FFS.  Regarding proposal 2, it’s not very clear if there is an advantage to defining a group-based priority scheme. |
| Xiaomi | Support option 1. But we can can accept option 3 to further discuss the details of the priority rule.  We have concern on option 2. If MISIM gaps as a group have higher priority than legacy MGs group, the measurement operations configured for NW A would be severely effected. |
| MTK | As we commented in the 1st round, Option 1 and 2 have their own pros and cons which require careful study, for which we also suggested Option 3 as a high-level agreement.  We also agree with the benefits highlighted by E/// for option 2, but we have different view on treating MUSIM periodic gaps as same priority. MUSIM gaps can have their own priorities which can be different. |
| vivo | It is hard to agree any one among option 1, 2 and 4 based on the discussion. Maybe option 3 can be agreed at the top level. Otherwise this topic should be open. |

**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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| **Company** | **Comments** |
| Ericsson | Based on Nokia’s comments, we think option 1 and option 2 isn’t contradictory between each other.  We suggest to use the following option 4 as an compromise agreement to further achieve the concern from company supporting option 1.   * Option 4(New): When collision happens between MUSIM gap and legacy measurement gap, gaps to be considered include all gaps defined till Rel-17 at least including Pre-MG, NCSG and concurrent gaps for measurement and other purposes (Ericsson)   + ~~FFS: Pre-MG and NCSG~~   + Note: The group needs to further consider how to handle Pre-MG/NCSG and Concurrent gaps which are discussed in parallel in WI further MG enh. |
| Apple | We are not sure about the difference between option 2 and 3. In our view this issue is about which types of gap need to be considered when discussing overlapping with MUSIM. If this is correct understanding, we believe RAN4 shall consider all gaps defined till R17. Any new gap which are to be introduced in R18 shall not be in the scope.  According to clarification from Nokia in the 1st round, we think the intention of option 1 is not to consider R18 new gap. It is more about collision in R18 scope, e.g. collision between Pre-MG and NCSG. The wording in option 1 may be misleading. |
| Nokia | Our comment in the 1st round was regarding the existing Rel 17 requirements, which do not consider combination of PreMG, NCSG and concurrent gaps. That means that if we would like to use Rel 17 as a baseline, we won’t be able to base the collision of MUSIM with other gaps based on legacy behavior. So it is unclear to us how to make the requirements for Pre-MG and NCSG. |
| Charter | We also are not sure about the differences between option 2 and option 3.  We support option 2, because in option 2 it is clear to us what kind of gaps we cover in the scope. |
| CMCC | Support Option 2. We are also not sure about the difference between option 2 and option 3. In our understanding, thery are same. |
| Huawei | We support moderator’s recommendation.  On option 1, we understand the concurrent MUSIM and other Rel-17 measurement gap types is in the scope of this WID.  On option 3, we think it is same as option 2.  On option 4 from E///, the main bullet already includes pre-MG and NCSG, so why they are FFS in the first sub-bullet? |
| Qualcomm | OK with the recommended WF. |
| Xiaomi | Support option 2 which is more clear from our view. |
| MTK | We support option 2. In our understanding, MUSIM gap collision with the legacy gaps should include all gaps defined till Rel-17, which also include Pre-MG, NCSG and concurrent gaps. |
| vivo | We support option 2 in principle. For Nokia’s concern how to handle the collision on Pre-MG and NCSG needs more study. |
| Ericsson | Thanks for Huawei’s comments. We update option 4 as follow. Hope it can be a compromise proposal to each company.   * Option 4(New): When collision happens between MUSIM gap and legacy measurement gap, gaps to be considered include all gaps defined till Rel-17 at least including Pre-MG, NCSG and concurrent gaps for measurement and other purposes (Ericsson)   + Note 1: The group needs to further consider how to handle Pre-MG/NCSG and MUSIM gaps.   + Note 2: The Pre-MG/NCSG and concurrent gaps are discussed in parallel in Rel-18 WI further MG enh. |

**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 ignalling 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 in Rel-17.*

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

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| **Company** | **Comments** |
| Ericsson | Agree with tentative agreements. |
| Apple | Agree with the tentative agreements. |
| OPPO | Agree with the tentative agreements. |
| Nokia | Fine with tentative agreement.  We corrected a minor typo, using change marks |
| Charter | Agree with tentative agreements. |
| CMCC | OK with tentative agreements. |
| Huawei | Agree with the tentative agreements. |
| Qualcomm | OK with the tentative agreement |
| Xiaomi | OK with the tentative agreement |
| MTK | Agree with the tentative agreements. |
| vivo | Ok with the tentative agreement |

**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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| **Company** | **Comments** |
| Ericsson | We suggest to further discuss this issue since all MUSIM gaps are black box to NW based on current RAN2 agreements.  To companies for option 3, could you further explain how to decide the priority based on NW’s perspective?  From our understanding, a default priority may be better to define the requirement. |
| Apple | Support option 3.  To Ericsson: as UE vendor, maybe we are not in the best place to explain how to decide priority based on NW’s perspective since it is up to NW implementation. We can come up with some examples, but eventually it is still under NW control. For instance for low mobility UE, MUSIM gap for NW B measurement can be with low priority. But for high mobility UE, NW may consider higher priority. From use case point of view, maybe gap for paging can have higher priority.  On the other way around, we couldn’t see why default priority can be better. At least for now we can observe that some company propose high priority (option 1) while some company propose low priority (option 2). This effectively explains why a certain level of flexibility is beneficial. |
| OPPO | Support option 3.  In addition, we think the priority may also rely on UE implementation. Since NW-A has no information about the task associated with each MUSIM gap, UE can also indicate the preferred priority when requesting the MUSIM gap configuration. (as discussed in Issue 2-3-5-1) |
| Nokia | We support option 4.  We think there are open questions regarding whether for example MUSIM gaps should have different high/low priority depending on the purpose. In case there is still collision a group priority can be assigned to resolve the collision. FFS to define different level of priority |
| CMCC | Option 3, which is more flexible. |
| Huawei | Support option 3.  We understand NW A can at least determine the priority between MUSIM gaps and other gaps for NW A measurement. Defining a default priority may limit the flexibility at NW A or the usage of MUSIM gaps at UE side. |
| Qualcomm | We support Option 1 as the default relative priority of MUSIM gaps vs. measurement gaps. i.e. by default, MUSIM gaps would have higher priority than measurement gaps.  We also support having flexibility to choose different priority level(s). However, we do not think it should be entirely up to network A to select the priority, for the reasons mentioned before (see issue 2-3-1-1). |
| Xiaomi | Support option 3 |
| MTK | We don’t think MUSIM gaps should have a fixed priority. As Apple commented, we think there are scenarios where MUSIM gaps should have higher priority than legacy gaps and vice versa. We appreciate that NW may not be able to define this priority properly under the current signaling framework, for which we think it is reasonable to study Option 1a from the previous issue with regards to this issue (which was proposed by Qualcomm as shown below):   * + - 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)   Therefore, we suggest updating Option 3 as: Up to NW/UE configuration |
| vivo | Support option 3. Fixed prirority is not preferred since it cannot adapt to different scenario. |

**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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| **Company** | **Comments** |
| Ericsson | Agree option 1 |
| Apple | Option 1. |
| Nokia | We are not ok with the WF. We want to keep this issue as FFS. |
| Charter | We support option 1 and the tentative agreements. |
| Huawei | Agree with option 1. |
| Qualcomm | Option 1 |
| Xiaomi | Agree with option 1. |
| MTK | Agree with option 1. |
| vivo | Agree with option 1. |

**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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| **Company** | **Comments** |
| Ericsson | We think option 3 may need to be updated based on proponent company’s further explanation.   |  |  |  | | --- | --- | --- | | |  |  | | --- | --- | | OPPO | Support option 1 and MTK’s clarification.  To Ericsson, the collision between two gaps is discussed for concurrent gaps in Rel17 and is defined as <=4m. Here we are considering a new collision type between SMTC/measurement resource for NW-A and MUSIM gap for NW-B, we think the definition for collision should be specified at first. | |     Instead of following the gap collision proximity agreed in concurrent gaps, we think the discussion in NTN is more suitable which is used for gap with SMTC.   |  | | --- | | For the case where one SMTC is inside MG and the other SMTC is outside the MG, if the proximity distance between the MG and SMTC outside the MG is smaller than or equal to the proximity distance threshold, i.e. 4ms, the two SMTCs are considered as colliding SMTCs |   We suggest to update option 3 as follow.   * RAN4 to discuss the proximity condition for the following cases: “SMTC is overlapping with MG” and “L1 measurement resource is overlapping with MG” |
| Apple | When supporting option 1, we had the 4ms condition in mind. Agree with E/// that discussion in NTN is more suitable for a baseline. |
| OPPO | We are open to discussion, and can also support the update option 3 from Ericsson.  Our original consideration is to reuse “overlapping in the time domain” as shown below, which means <=0ms in our understanding.  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 NCSG, 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, or according to CSSFwithin\_ncsg,i in clause 9.1.5.3 for measurement conducted within NCSG, i.e. when intra-frequency SMTC is fully overlapping with NCSG.  The conclusion from NTN cannot be reused directly. It is the collision between two SMTCs, where one SMTC is within gap and the other SMTC is outside MG. While in this case, SMTC may not be contained within MUSIM gap. So we are open to further discussion. |
| Nokia | Tentative agreement still not clear.  We think the proposal from Ericsson is ok. |
| Huawei | We support option 3 with the consideration as explained by OPPO above.  However, it seems there are different understandings among companies, so we are also ok to keep it open as suggested by E///. |
| Qualcomm | We are OK to discuss further. |
| Xiaomi | Support option 3 and share the similar view with OPPO. Open to further discuss. |
| MTK | Option3. We also have same understanding as OPPO for the “overlap” here. To avoid confusion, we are also fine to keep it open. |
| vivo | OK for FFS |
| Ericsson | Thanks for oppo’s further clarification. Now I think we have different understanding on this condition.  We think it should further consider the proximity discussed in NTN other than only the fully/partially overlapping case. |

**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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| **Company** | **Comments** |
| Ericsson | We think it’s too early to have any conclusion if no agreement on the scenarios achieved.  Before the group to further discuss this issue, we want to clarify the following scenarios for further discussion.   * Scenario 1: MUSIM gaps collide with SSB/SMTC for L1/L3 measurement * Scenario 2: MUSIM gaps collide with SSB/SMTC for RRC CONNECTED mobility procedures, such as Handover, SCell activation, TCI state switching, etc. * Scenario 3: MUSIM gaps collide with Paging and system info. update for NW-A * Scenario 4: MUSIM gaps collide with important uplink signals, such as PRACH, CSI-RS reporting which is used to indicate the completion of any RRC CONNECTED mobility procedure for NW-A |
| Apple | Fine with option 1 and 3 as baseline. Open to further discussion on scenarios mentioned by E///. |
| OPPO | Support option 1 and 3.  We understand this issue is for collision between MUSIM gap and L3/L1 measurements without gap. In the current spec with legacy gap for NW-A, legacy gap is prioritized by default.  For scenario 3 and 4, we are open to further discussion. |
| Nokia | We also think this is too early for such detailed agreement. |
| CMCC | Can be FFS |
| Huawei | We support option 1 as baseline.  Other solutions for handling collision between MUSIM gaps and SMTC/L1 can be FFS. |
| Qualcomm | We support option 1. |
| Xiaomi | For the issue on priority of MUSIM against SMTC, and other L3/ L1 measurement resources, which is similar to scenario 1 listed by Ericsson, we support option 1 and 3.  For other scenarios, we are open to further discuss. |
| MTK | Support Option 1.  MUSIM gaps should have higher priority when collide with SMTC or L1 measurements. This follows the same principle when such collision happens with the legacy gaps.  We are also open to further discuss scenario 3 and 4 from E///. |
| vivo | Ok with option 1 and open for further discussion on all scenarios identified. |
| Ericsson | For scenario 1, we think it’s straightforward, but it should be captured clearly.   * Scenario 1: When MUSIM gaps collide with SSB/SMTC for L1/L3 measurement, MUSIM gaps should have higher priority.   We think other scenarios are more complex. |

**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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| **Company** | **Comments** |
| Ericsson | Option 1, 2, 3.  From our understanding, CSI-RS reporting for SCell activation completion should also be prioritized except of PRACH.  We suggest the group to further check other important RRC procedures except L1/L3 periodic measurement. |
| Apple | Open for further study. |
| Nokia | FFS |
| CMCC | Option 3 |
| Huawei | We understand the issue is similar to above 2-3-3-2, and suggest FFS. |
| Qualcomm | FFS |
| Xiaomi | We can further study this issue. |
| MTK | Support option 2 also fine to keep it FFS. |
| vivo | OK for FFS |

**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 Ericsson)
    - Option 2a: 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)
    - Option 3: Aperiodic gap should have higher priority than periodic gaps once collision happens within MUSIM gaps. (Ericsson MTK)
    - Option 4: It is UE’s responsibility not to request colliding MUSIM gaps from NW-A (Nokia)
    - Option 5: Option 2 can be discussed if option 1 is agreed (Charter MTK)
      * Option 5a: Option 3 can be discussed if option 1 is agreed (Charter)

*Tentative agreements: No*

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| **Company** | **Comments** |
| Ericsson | Option 2, 2a, 4.  We add option 2a which is an important case needs to be discussed for this collision within MUSIM gaps option 2.  We think option 1 priority rule is unnecessary for MUSIM gaps. In ConMGs, UE will use the MG only to perform measurement. The reason to define the gap dropping rule is UE cannot switch too fast between different gaps for different frequency’s measurement. However, in MUSIM gaps, one periodic gap will be used for measurement, one periodic gap for paging reception and another periodic gap for SIB decoding. Could the companies support option 1 to further explain the use case for priority rule in MUSIM gaps?  Instead of dropping the gap, UE should perform some procedures together. For example, UE should retune the AGC and receive the paging which had already agreed in Idle mode. In this case, we think both gaps(one for measurement and AGC; one for paging) shouldn’t be dropped. If the two gaps meet the proximity rule, UE should keep both gap occasions instead of dropping any of them. |
| Apple | Support option 1 as baseline. Open for further discussion on optimization. |
| OPPO | Prefer option 1. In our understanding, one benefit for priority rule is that NW-A can schedule data transmission during the dropped MG occasion to avoid throughput loss. |
| Nokia | C  In any case we think Option 4 would be agreeable |
| CMCC | Option 1. In general, we agree that priority rule can be used as baseline, but the details or optimization can be FFS. |
| Huawei | Support option 1 and 2.  We think option 1 can be used as baseline, and other solutions can be FFS as in option 2. We agree with the observation from E/// that UE may keep both MUSIM gaps even when they are colliding. Unlike in con-MG where two MGs are used for measurements, the two MUSIM gaps may be used for different purposes such as sync and paging, so it may be reasonable to keep both. |
| Qualcomm | Option 2 |
| Xiaomi | Support option 1 as baseline. |
| MTK | Support Option 1.  We appreciate that collision in concurrent gaps happens between two MGs meant for measurements, however, this could also apply for MUSIM gaps collisions. Since we don’t have gap association in MUSIM gaps, MUSIM gaps collisions could happen between different activities in NW B, for example, between two measurements, between measurement and paging reception, or between measurements and SIB, etc.  Therefore, we think priority rule should be applied as a baseline for these collisions between different MUSIM gaps. |
| vivo | Support option 1 at least as the baseline. Not sure how option 4 works since during Rel-17 concurren gap discussion, it was discussed that the collision can be avoided through NW configuration however in the end this was proved to be impractical. |
| Ericsson | To MTK, could you further explain this measurement collision scenarios in MUSIM?  Based on current discussion in Rel-17, UE can request three periodic gaps. One is for measurement, one for paging, and the other for SIB decoding. Could you further explain the reason why UE wants to apply for two gaps for measurement and drop the paging monitoring or SIB decoding? |

**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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| **Company** | **Comments** |
| Ericsson | We support option 1.  To QC,  From our understanding, the gap proximity condition can be reused. The important issue is how to handle UE’s behaviour when this proximity condition is met. |
| Apple | Support option 1. |
| Nokia | If we understand the moderator comment correct, this is only relevant for Network B requirements, if we decide to specify it. |
| Charter | We support option 1. |
| Huawei | Option 1. |
| Qualcomm | Option 2. To Ericsson: based on your comments there may be different behavior for collisions between MUSIM gaps. We think that should be considered and it may make sense to modify the proximity condition if new behavior is defined. |
| Xiaomi | Support option 1 |
| MTK | Support Option 1. |
| vivo | To Nokia, this is to define conditions when two MUSIM gap are called to be collided. To my understanding it is also related to network A requirement since we needs know whether or which MUSIM is left in the end.  Prefer option 1 and Ok for FFS |

**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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| **Company** | **Comments** |
| Ericsson | Option 1.  From our understanding, aperiodic gap should be higher priority than other gaps. Otherwise, the aperiodic gap will be dropped when collision happens. Then what’s the meaning for UE to apply for this aperiodic gap? |
| Apple | Option 1 and 2 are not mutual exclusive. In option 1 UE ‘can’ … doesn’t mean UE ‘has to’. It may be true that aperiodic gap has higher priority most of the time. However, if RAN4 agrees to study solutions on top of priority based solution (as supported by several companies), it is possible that UE requests equal priority in this scenario. |
| Nokia | A gap priority – no matter it is periodic or aperiodic – should depend on the procedure for which the gap is requested. |
| Charter | We support option 1. |
| CMCC | Can be FFS. |
| Huawei | Suggest FFS on how to handle collision between aperiodic gap and other gaps. |
| Qualcomm | OK to keep FFS. |
| Xiaomi | OK to keep FFS. |
| MTK | FFS. We appreciate the motivation but not clear what exactly aperiodic MUSIM gap should be higher priority than. |
| vivo | More clarification on option 1 is needed. Anyway it can be up to UE implementation. |
| Ericsson | We think aperiodic gap should have higher priority than other periodic gaps since it’s a one shot gap. If this gap has lower priority, we don’t think it needs to be requested since it will be dropped when collision happens. |

**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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| **Company** | **Comments** |
| Ericsson | Option 3.  It’s too early to discuss this issue. |
| Apple | FFS. |
| OPPO | We are open to further discussion. |
| Nokia | FFS |
| Charter | We are fine to postpone this for later. Option 3 |
| CMCC | Option 3. |
| Huawei | Option 3, suggest to postpone the issue after the previous one 2-3-5-1 is resolved. |
| Qualcomm | FFS |
| Xiaomi | Option 3 |
| MTK | We are also fine to FFS. |
| vivo | We also feel it is too early to discuss it. Fine for FFS |

### 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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| **Company** | **Comments** |
| Ericsson | Option 1.  From our understanding, option 3 which is just one solution for option 1 isn’t contradictory to option 1.  We think it’s important to define UE’s requirement for NW B. Otherwise, the whole MUSIM gaps will be a black box for both NW-A and NW-B. |
| Apple | Option 2 and 4. Note that MUSIM gap may be dropped according to previous open issues, which makes operation in NW B more like a best effort operation. |
| Nokia | We prefer Option 2.  Network B requirements apply. |
| Huawei | Option 2. |
| Qualcomm | Option 2 |
| MTK | Support Option 2. |
| vivo | Ok with option 2 or 4. |
| Ericsson | To moderator  Could you further explain this option 2?  We don’t think option 2 means NW-B should follow the legacy Idle mode requirement. Instead, it means no requirement for MUSIM UE in NW-B. |
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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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| **Company** | **Comments** |
| Ericsson | We can reuse the conclusion in concurrent gaps if MUSIM gaps can be believed as ‘one gap’. |
| Apple | The conclusion in concurrent gaps is to limit the MGRP, which cannot be directly reused if we considered MUSIM gaps as ‘one gap’.  Besides, conclusion in concurrent gaps was concluded based on assumption of up to two gaps in one FR. For MUSIM gaps there could be more gaps than that. We are open for further study. |
| OPPO | FFS.  The number of MUSIM gaps (up to 3) and MUSIM gap patterns (larger MGRP, and aperiodic gap) are different from that for concurrent gaps. The conclusion for concurrent gaps cannot be reused. |
| Nokia | Either Option 3, 1 wait for Rel 17 concurent gap conclusion or FFS. |
| Charter | We support option 4 and wait with any conclusion after the conclusion in concurrent gap. Then we may decide if we should use the same conclusion as in concurrent gap or not. |
| Huawei | Option 4.  We are not sure if con-MG conclusion can be directly re-used because only two MGs are considered. |
| Qualcomm | Option 4 |
| Xiaomi | We share the view with Apple and OPPO that, for MUSIM gap the number of gaps are different from concurrent gaps. So the conclusion on overhead for concurrent gap cannot be directly reused to MUSIM gaps.  It was agreed in concurrent gap that “*Regarding the overhead cap on concurrent gaps in Rel-17, measurement requirement does not apply when more than one MGP is configured with MGRP=20ms in an FR*”. We prefer to take this as baseline and further consider the number of gaps issue. Open to further discuss. |
| MTK | Fine with option 4, given that concurrent gap conclusion might not be directly applicable. |
| vivo | FFS. |

**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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| **Company** | **Comments** |
| Ericsson | Option 1  From our understanding, it’s important to define the pre-condition in which UE is considered to be in MUSIM mode and request MUSIM gaps. For example, we’ll further consider MUSIM procedures to operate in RRC\_CONNECTED state simultaneously in NW A and NW B soon. |
| Apple | Support option 2 at current stage. |
| Nokia | We agree with Ericsson that a pre-condition needs to be specified.  Otherwise it is not clear when the UE is allowed to request MUSIM gaps, which have a clear scope on the application. |
| Huawei | Option 2.  We understand the current objective is for scenario where UE is in CONNECTED in NW A and IDLE/INACTIVE in NW B, as discussed in Rel-17. |
| Qualcomm | Option 2 |
| MTK | Support option 2. |
| vivo | Support option 2. |
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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