**3GPP TSG-RAN WG2 Meeting #121bis-e R2-2304398**

**Online, April 17-26, 2023**

**Agenda item: 7.17.4**

**Source: Samsung**

**Title: Report of [AT121bis-e][231][MUSIM] RAN4 aspects of MUSIM (Samsung)**

**Document for: Discussion**

# 1 Introduction

This document is the report of the following offline discussion:

* [AT121bis-e][231][MUSIM] RAN4 aspects of MUSIM (Samsung)

Scope: Discuss what to do in RAN2 for MUSIM gap priorities (based on RAN4 LS): Can UE indicate gap priority preference? Is the gap priority applicable to aperiodic gaps? What is the network behaviour (i.e. accept/reject/change priority)? Are there any RAN4 impacts on maximum UL power change?

Intended outcome: Discussion report in [R2-2304398](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2304398.zip)

Deadline: Deadline 2 (Friday W1, 0900 UTC)

# 2 Contact information

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# 3 Discussion

### 3.1 MUSIM gap priorities

In [1, 4, 5, 10], it mentions that there is a need to introduce new UE capability to indicate whether UE supports providing MUSIM gap priority preference and its related configuration.

**Q1: Do you agree to introduce a per-UE capability bit to indicate support of MUSIM gap priority configuration and preference?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | Agree | It’s natural to introduce a per-UE capability bit to indicate support of MUSIM gap priority configuration and preference. |
| Huawei/HiSilicon | Agree |  |
| Intel | Agree | We can even include that there is no need for xDD and FRx differentiation. |
| Nokia | Agree |  |
| Apple | Agree | We think that a per UE capability is a natural requirement for this gap priority feature |
| ZTE | Agree | In detail, we think it should take the ***musim-GapPreference-r17*** as prerequisite |
| OPPO | Agree |  |
| Qualcomm | Agree |  |
| MediaTek | Agree |  |
| DENSO | Agree |  |
| Ericsson | Agree |  |
| Sharp | Agree |  |
| Charter | Agree | As long as the gap configuration is still provided by the NW and UE only indicates if it supports MUSIM gap priority. |
| Xiaomi | Agree |  |
| Samsung | Agree |  |

*Summary:* *There is unanimous support for the need to introduce a per-UE capability bit to indicate support of MUSIM gap priority configuration and preference; 1 company further suggested to clarify that there is no need for xDD and FRx differentiation for this capability, which makes sense to follow existing specification; 1 company further stated that this new capability should take existing capability "musim-GapPreference-r17" as prerequisite.*

**Proposal 1: Introduce 1 optional per-UE capability bit (without xDD/FRx differentation) to indicate MUSIM gap priority configuration and preference. A UE supporting this feature shall also support *musim-GapPreference-r17*.**

It is mentioned in [4, 9, 10] that MUSIM gap priority preference can be reported if UE is configured to do so i.e. explicit network configuration in the OtherConfig.

**Q2: Do you agree to introduce a new indication in the OtherConfig to indicate whether UE is allowed to report MUSIM gap priority preference via UAI?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | Agree | Similar to the legacy UAI mechanism. |
| Huawei/HiSilicon | Agree |  |
| Intel | Agree |  |
| Nokia | Agree |  |
| Apple | Agree |  |
| ZTE | Agree |  |
| OPPO | Agree |  |
| Qualcomm | Agree |  |
| MediaTek | Agree |  |
| DENSO | Agree |  |
| Ericsson | Agree | Yes, this aligns with existing pinciple |
| Sharp | Agree |  |
| Charter | Agree |  |
| Xiaomi | Agree |  |
| Samsung | Agree |  |

*Summary: There is unanimous support for the need to introduce a new indication in the OtherConfig to indicate whether UE is allowed to report MUSIM gap priority preference via UAI, with the rationale that it aligns with existing principle.*

**Proposal 2: Introduce a new indication in the *OtherConfig* to indicate whether UE is allowed to report MUSIM gap priority preference via UAI.**

According to RAN4’s agreement [13], UE can also provide an assistance information for the periodic MUSIM gap priority selection by indicating its preferred priority for all or a subset MUSIM gaps. The rapporteur thinks that the following feasible options need to be discussed as proposed in [6, 9, 12]:

* Option 1: UE indicates an absolute priority for all or a subset periodic MUSIM gaps by taking into account of the Type-2 MG gap priority
* Option 2: UE indicates a relative priority for all or a subset periodic MUSIM gaps, i.e. the priority is relative just among the MUSIM gaps

Note that it is mentioned in [6] that RAN2 may wait for RAN4 feedback for which option to be supported.

**Q3: Which of the following options do you prefer for indicating periodic MUSIM gap priority preference?**

* **Option 1: UE indicates an absolute priority for all or a subset periodic MUSIM gaps by taking into account of the Type-2 MG gap priority**
* **Option 2: UE indicates a relative priority for all or a subset periodic MUSIM gaps, i.e. the priority is relative just among the MUSIM gaps**
* **Option 3: wait RAN4 progress/feedback**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option(s) | Comments (if any) |
| vivo | Option 2 | Option 2 relative priority is preferred.  Firstly, it’s sufficient for the UE to report the relative priority values among the periodic MUSIM gaps and it’s up to the network how to configure the relationship of MUSIM gap priorities and MG gap priorities. The value range of relative priority is smaller than the absolute ones, which helps minimize the ASN.1 size.  Secondly, in option 1, if the highest priority has been used for configured measurement gap, e.g. priority 0-3. How does UE report one absolute gap priority for paging usage in value range [0-3]? The priority preference is not clear if priority preference value equals to configured gaps.  We are fine with option-1 as well if majority prefers it. |
| Huawei/HiSilicon | Option 2 | Currently, the Type-2 MG gap priority is decided by NW without UE providing any preference, we can follow this principle and the UE does not need to consider the priority between Type-2 MG and MUSIM gap. Furthermore, when the NW reconfigures the Type-2 MG priority for the UE, the UE does not need to re-initiate the UAI procedure to update the MUSIM gap priority. |
| Intel | Option 1 or 3 | Based on the following in the LS:   * + The priority level of MUSIM gap(s) shall be configured to be comparable to priority level of NW A’s Type-2 MGs     - MUSIM gap and Type-2 MG cannot be configured with the same priority   Our understanding is leaning more to Option 1. However, we are fine to check with RAN4 or wait for further progress in RAN4. Particularly, it is unclear to us why it is optional for the UE to not indicate its preferred priority for a MUSIM gap in the prefereince indication. Does it mean that it is lowest priority (or highest priority)? |
| Nokia | Option 1 is preferred. | RAN4 LS indicates the NW assigned priority should be unique across MUSIM gaps and Type-2 gaps. If the UE intend to have better priority over Type-2 gaps for some of its gaps, it is good to indicate the same for NW to consider in its assignment. Otherwise NW may allocate lower priority than Type-2 which is not preferred for UE. |
| Apple | Option 1 or 3 | Option 1 in our view results in unambiguous priority setting. At the same time, we are fine to wait for RAN4 input if any on this. |
| ZTE | Option 1 or 3 | The absolute value can also indicate the relative priority, so seems that the option 1 implies more information, then it can be left to the network to determine to comply with the absolute priority or just comply with the relative priority |
| OPPO | Option 1 or Option3 | Option 1 is simpler and straightforward. |
| Qualcomm | Option 1 | This gives a lot more information to the NW compared to Option 2 since it indicates the relative priority among MUSIM gaps as well as the actual priority UE requests compared to other non-MUSIM gaps. |
| MediaTek | Option 2 | It is a little unclear to us on option 1.  Does option 1 imply that the UE also suggest gap priority for Type-2 gap?  If there is no Type-2 gap configured, does this imply that option 1 and 2 are the same?  What happen to option 1 if Type-2 gap is configured after the UE providing the MUSIM gap preference?  It is also unclear to us how UE determine the priority between MUSIM gap and Type-2 gap. |
| DENSO | Option 1 | Option 1 seems to be simpler and straightforward. |
| Ericsson | Option 1 | Problem for Nw is that Nw does not know what UE is doing within the Musim gap. Nw can only make a guess based on the UE-indicated preferences. |
| Sharp | Option 1 or 3 | Considering that RAN4 will have further discussion, we can wait for RAN4 input. But if RAN2 would like to make a choice, we think it is straightforward to have option 1. |
| Charter | Option 2 | Agreed with vivo. |
| Xiaomi | Option 1 | Option 1 seems simpler than other options. If RAN4 made further agreements or changes, RAN2 can follow RAN4 agreements accordingly. |
| Samsung | Option 1 |  |

*Summary: 11 companies (Intel, Nokia, Apple, ZTE, OPPO, Qualcomm, DENSO, Ericsson, Sharp, Xiaomi, Samsung) prefer Option 1; 4 companies (vivo, Huawei, MediaTek, Charter) prefer Option 2; 5 companies (Intel, Apple, ZTE, OPPO, Sharp) prefer Option 3*

* *Proponents of Option 1 commented that it seems to be aligned with RAN4 answer given that RAN4 indicated that MUSIM gap and Type-2 MG cannot be configured with the same priority. It was also commented that it gives more information than Option 2 to allow network to determine to comply with the absolute priority or just comply with the relative priority. It was further stated that option 1 is simpler and straightforward. 1 company wondered why it is optional for the UE to not indicate its preferred priority for a MUSIM gap in the prefereince indication. Note that among proponents of Option 1, 5 companies expressed that it is fine to wait RAN4 input.*
* *Proponents of Option 2 commented that option 2 is sufficient with less signalling overhead since it is up to network how to configure the relationship of MUSIM gap priorities and MG gap priorities. It was also commented that UE does not need to re-initiate the UAI procedure to update the MUSIM gap priority when network reconfigures the Type-2 MG priority for the UE. 1 company asked some questions on ambiguity of Option 1. 1 company expressed that it is fine to go with Option 1 if majority prefers it.*

*There is a majority view but it is also observed that there are some questions how Option 1 works as Mediatek pointed out i.e. whether the intent of Option 1 is just to take Type-2 MG gap priority, if configured or UE can also indicate preference on Type-2 MG gap priority, etc. Thus, the rapporteuer thinks it is better to make the proposal open and discuss it online.*

**Proposal 3: RAN2 to discuss how UE indicates periodic MUSIM gap priority preference**

* **Option 1: UE indicates an absolute priority for all or a subset periodic MUSIM gaps by taking into account of the Type-2 MG gap priority**
* **Option 2: UE indicates a relative priority for all or a subset periodic MUSIM gaps, i.e. the priority is relative just among the MUSIM gaps**
* **Option 3: wait RAN4 progress/feedback**

Regardless of the outcome of Q3, the rapporteur understands that most companies propose that the existing IE *GapPriority-r17* can be re-used to configure the priority for periodic MUSIM gap, regardless of the outcome of Q3.

**Q4: Do you agree that the existing IE GapPriority-r17 is re-used to configure the priority for periodic MUSIM gap?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | Agree | The existing IE *GapPriority-r17* can be re-used by the network to configure the priority for periodic MUSIM gap.  However, the value range of gap priority preference relies on the outcome of Q3. |
| Huawei/HiSilicon | Agree |  |
| Intel | Agree |  |
| Nokia | Agree |  |
| Apple | Agree |  |
| ZTE | Agree |  |
| OPPO | Agree |  |
| Qualcomm | Agree |  |
| MediaTek | Agree |  |
| DENSO | Agree |  |
| Ericsson | Agree |  |
| Sharp | Agree |  |
| Charter | Agree | No need to introduce new IE. |
| Xiaomi | Agree |  |
| Samsung | Agree |  |

*Summary: All companies agree that the existing IE GapPriority-r17 is re-used to configure the priority for periodic MUSIM gap.*

**Proposal 4: The existing IE *GapPriority-r17* is re-used to configure the priority for periodic MUSIM gap.**

In Rel-17, RAN2 has agreed that network should always provide at least one of the requested gap pattern or no gaps i.e. network is NOT allowed to provide an alternative gap pattern instead of the one requested by the UE. Thus, it is proposed in [3] that network should accept the MUSIM gap priorities requested by the UE. The rapporteur understands that the intent is for network to assign the priority which is equal to the absolute value provided by the UE (if Option 1 is agreed in Q3) or is aligned with the relative value provided by the UE (if Option 2 is agreed in Q3) [9].

**Q5: When network accepts gap priority preference for a periodic MUSIM gap, do you agree that network configures the priority which is equal to the absolute value provided by the UE (if Option 1 is agreed in Q3) or is aligned with the relative value provided by the UE (if Option 2 is agreed in Q3)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | Agree (aligned with the relative value provided by the UE) | Considering network may configure new measurement gaps, it’s impossible for network to always accept the absolute priority value provided by the UE.  No matter Option-1 or Option-2 is agreed in Q3, we think network configures the MUSIM priority which is aligned with the relative priority relationship among MUSIM gaps provided by the UE. |
| Huawei/HiSilicon | Agree (Aligned with the relative value provided by the UE) | Based on existing mechanism, for UE suggested MUSIM gaps, if the gNB decides to configure the MUSIM gaps, the gap patterns configured should be the same as the UE’s preference, to match the activities in SIM B. The same motivation applies for UE suggested priority for MUSIM gaps, since only the UE knows the intention (e.g. for paging reception, or RRM measurements, or SI reception) for different MUSIM gaps.  Besides, since only relative priority for MUSIM gap should be aligned, the NW still has flexibility for configure priority between Type-2 MG and MUSIM gap. |
| Intel | Agree (Option 1 in Q3) |  |
| Nokia | Agree (with Option 1 in Q3) |  |
| Apple | Agree (with Option 1 in Q3) |  |
| ZTE | See comments | Same as Q3: The absolute value can also indicate the relative priority, so seems that the option 1 implies more information, then it can be left to the network to determine to comply with the absolute priority or just comply with the relative priority. |
| OPPO | Agree (Option 1 in Q3) |  |
| Qualcomm | See comment | For Option 1, the NW can still change the absolute priorities while keeping the relative priorities among MUSIM gaps. For Option 2, agree that the NW should keep the relative priorities. |
| MediaTek | Agree (Aligned with the relative value provided by the UE) |  |
| DENSO | Agree (with Option 1 in Q3) |  |
| Ericsson | See comments | Priority setting should be left to Nw impl. We expect no restriction on nw impl as imposed by this q-n will be specified. This should be the conclusion. |
| Sharp | Agree (with Option 1 in Q3) |  |
| Charter | Agree |  |
| Xiaomi | Agree (with Option 1 in Q3) |  |
| Samsung | Agree (with Option 1 in Q3) |  |

*Summary: 8 companies agree that network configures the priority which is equal to the absolute value provided by the UE if Option 1 in Q3 is agreed; from those companies, network can configure the priority by complying with the absolute priority or complying with the relative priority. 3 companies agree that the network configures the priority which is aligned with the relative value provided by the UE. 1 company mentioned that it can be totally up to network implementation.*

*Note that it depends on the outcome of Q3. Hence, it is suggested to discuss the following proposal after discussing P3 first:*

**Proposal 5: RAN2 to discuss how to configure the priority when network accepts gap priority preference for a periodic MUSIM gap**

* **Option A: Network configures the priority which is equal to the absolute value provided by the UE if Option 1 in Proposal 3 is agreed. FFS whether network can still change the absolute priorities while keeping the relative priorities among MUSIM gaps**
* **Option B: Network configures the priority which is aligned with the relative value provided by the UE.**

If network can't accept MUSIM gap priority preference, simplest options may be not to assign any priority for a requested periodic MUSIM gap or not to configure a periodic MUSIM gap at all. But further question is raised in [3] whether a fallback option could be for network to follow the relative priorities among periodic MUSIM gaps i.e. assign different priorities for periodic MUSIM gaps while still following the relative ordering between them. The rapporteur understands that this fallback option is valid if the outcome of Q3 is Option 1.

**Q6: When** **network can't accept MUSIM gap priority preference for a periodic MUSIM gap, which of the following options do you support for network behavior?**

* **Option A: does not configure a periodic MUSIM gap at all**
* **Option B: does not assign any priority while configuring a periodic MUSIM gap**
* **Option C: use fallback option as in [3]**
* **Others**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option(s) | Comments (if any) |
| vivo | Option C | RAN4 LS has concluded that “It is up to NW A on how to use this (preference) information.”  If NW A cannot accept the priority level indicated by a UE, network configures the MUSIM priority which is aligned with the relative priority relationship among MUSIM gaps provided by the UE. |
| Huawei/HiSilicon | See comment | As commented in Q3, we prefer the UE to indicate a preference for a relative priority for all or a subset periodic MUSIM gaps. In this case, we cannot imagine for what reasons the NW cannot accept such relative priority preference of the UE. |
| Intel | Others | It is unclear to us why network cannot provide a priority when the UE has requested a priority preference. |
| Nokia | See comment | As the NW may decide on relative priority across Type-2 Gaps and MUSIM gaps, we should allow network to change the priority. This is needed at least for the priority across MUSIM and Type-2 priority. Within MUSIM gap priority the NW should attempt to keep the same order.  Also RAN2 need to discuss the UE behaviour if priority is not assigned or not accepted to all the requested priority. In such cases the Type 2 gaps of NW-A should be given higher priority by default. The priority handling among MUSIM gaps can be left to UE implementation |
| Apple | See comment | Our understanding is that the NW if it is not able to provide the UE requested priority, should atleast provide a default priority. Otherwise, the UE would be force to retrigger this signalling request again, which should be avoided. |
| ZTE | Option C | We agree with Rapporteur that this fallback option is valid if the outcome of Q3 is Option 1 |
| OPPO | See comment | I don’t understand the issue very clear, even if network can't accept MUSIM gap priority preference for a periodic MUSIM gap, it’s still up to NW implementation to configure the priority for each MUSIM gap, a good NW implementation will consider all the available info on the table including MUSIM preference info, so no need to clarify something in the spec, just leave this to NW implementation. Only one thing that matters is to define the UE behavior when a priority is absent for a specific gap when configured in DL, i.e. to answer Q8. |
| Qualcomm | See comment | Agree with HW that the NW should keep the relative priority, irrespective of Option 1 or 2 is agreed. If NW can not do this, it will not schedule MUSIM gaps (similar to Rel-17 MUSIM gap request). |
| MediaTek | See comment | It could be just up to NW implementation with the understanding that sensible NW should follow the priority suggestion. |
| DENSO | Option C | Agree with rapporteur. NW might not use the exact value provided by the UE as this should be up to network implementation. If Option 1 in Q3 is introduced, this behavior could be called “fallback option”. |
| Ericsson | See comments | Priority setting (and even configuration of MUSIM gaps) is for Nw impl to decide. Of course Nw should take UE prefence into account. Seems simplest Nw always provide a priority. |
| Sharp |  | We do not think we need to make any restriction on it. It can left to NW implementation. |
| Charter | Option C |  |
| Xiaomi | See comments | We think that if the network does not provide a priority and the reporting of the priority assistance information is allowed, the UE should be able to re-send the priority. Otherwise, the network should disable the reporting of the priority assistance information. |

*Summary:* *6 companies agree with Option C; from those companies, 1 company mentioned that there is no case for network not to assign any priority, while 1 company mentioned that network does not configure the periodic MUSIM gap at all if Option C is not possible. 1 company claimed why network cannot provide a priority when the UE has requested a priority preference. 1 company suggested to provide a default priority if network is not able to provide the UE requeted priority. 4 companies think that it can be just up to network implementation; from these companies, 1 company thinks the UE can consider the periodic MUSIM gap without priority to be the lowest priority. 1 company suggests to discuss the intended UE behavior if priority is not assigned or not accepted to all the requested priority. 1 company mentions that UE can re-send the priority if network does not provide its preferred priority or network can disable the reporting of the priority assistance information.*

*Rappoteur thinks that companies' views are quite divergent on 1) whether we need to specify any NW behavior, 2) whether network has an option not to provide a priority when UE has requested a priority preference and/or if so what is the intended UE behavor. Thus, it seems hard to make any good progress on this topic. Rapporteur would like to not make any concrete proposal for now and suggests to discuss this issue at the next meeting.*

According to RAN4 LS [13], it is stated that each periodic MUSIM gap can be assigned with a different priority. But two companies in [2, 10] would like to discuss whether network can configure the same priority to the periodic MUSIM gaps.

**Q7: Do you agree that network can configure the same priority to more than one periodic MUSIM gap?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | See comment | Whether different periodic MUSIM gaps can have same priority or not, it is under discussion in RAN4 for a few meetings already, we suggest to wait for RAN4 progress. |
| Huawei/HiSilicon | See comment | Wait RAN4 progress  In our view, the issue of same priority is not only about NW configured priority, but also UE reported priority. As we mentioned above, we think the NW configured priority should be aligned with UE reported relative priority, if UE can report same priority, then the NW can configure same priority. Whether UE can report same priority is being discussed in RAN4 so we can wait for RAN4 progress. |
| Intel | Check with RAN4 | We can check with RAN4 whether collision handling needs to be performed among the MUSIM gaps. |
| Nokia | No | Same priority across the gaps is not allowed as per RAN4 LS. |
| Apple | See comment | Based on our contribution in [8] we feel RAN4 should clarify this part. Currently it is not clear if different periodic gaps can have the same priority. |
| ZTE | Wait for RAN4’s progress | We think it depends on how to solve the collision, some Gap collision solution methods (e.g. gap merging) are under RAN4 discussion, so we’d like to wait for RAN4’s progress. |
| OPPO | Check with RAN4 |  |
| Qualcomm | Yes | But also fine to wait for RAN4 on collision handling. |
| MediaTek | No | According to current RAN4 LS, we think same priority is not allowed. But could change depending on RAN4 further conclusions. |
| DENSO | Check with RAN4 |  |
| Ericsson | Disagree | Seems simplest Nw configures different priorities. We expect UE ensures the MUSIM gap collitions are avoided. |
| Sharp |  | We can wait for RAN4 progress. |
| Charter | See comment | It seems there shouldn’t be any overlapping or conflict if different periodic MUSIM gaps are assigned the same priority. Agreed with vivo to wait for RAN4’s report on this. |
| Xiaomi | Check with RAN4 |  |
| Samsung | Check with RAN4 |  |

Summary: *13 companies expressed that RAN4 input is required; from those companies, 7 companies expressed to wait for RAN4 progress while 5 companies preferred to check with RAN4, 1 company thinks that this should be clarified in RAN4 as it is not clear if different periodic gaps can have the same priority. 3 companies mentioned that same priority is not allowed. The rapporteur thinks that we can either just wait RAN4 progress or ask RAN4 to this topic.*

**Proposal 6: RAN2 to discuss whether to ask RAN4 on the same priority for periodic MUSIM gaps i.e. whether UE can report the same priority for different periodic MUSIM gaps and/or whether network can configure the same priority for different periodic MUSIM gaps.**

According to RAN4 agreement [13], it is optional for UE to indicate its preferred priority for a periodic MUSIM and it is up to network to decide how to use such information. Thus, it seems quite natural that network can configure a periodic MUSIM gap without any assigned priority, which is related with the following highlighted agreement is made:

* RAN2 will aim to address the RAN4 LS in Rel-18 signalling. Should discuss how to handle Rel-17 gaps without priority (e.g. lowest, highest, network-decided somehow, etc.). Handled in email [231]

Note that the focus here is to handle periodic MUSIM gaps without priority i.e. the applicability of priority for aperiodic MUSIM gap will be discussed later on.

In [1], it is suggested that a default priority level should be used for periodic MUSIM gaps which do not have an assigned priority. In [5], it is proposed that absence of configured priority indicates the lowest priority for the gap when there is conflict with other NW-A Type-2 gaps or other MUSIM gaps.

**Q8: How UE supporting to indicate periodic MUSIM gap priority preference handles a configured periodic MUSIM gap without priority?**

* **Option 1: UE uses a default priority value**
* **Option 2: UE considers a configured periodic MUSIM gap without priority to be the lowest priority gap i.e. lower than any of the network configured priority values**
* **Others**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option(s) | Comments (if any) |
| vivo | others | Based on RAN4 discussion, we may assume that, Network A assigns priority levels to all configured periodic MUSIM gaps even if UE does not indicate preferred priority for one or some periodic MUSIM gaps. Then, the case of this question is impossible. |
| Huawei/HiSilicon | See comment | Wait RAN4 progress.  RAN4 is discussing “Solution for collision between MUSIM gap and Type-1 MG or gap configured without priority” hence we can wait for RAN4 progress. |
| Intel | Others | It is unclear to us why it is optional for the UE to not indicate its preferred priority for a MUSIM gap in the preference indication. Does it mean that it is lowest priority (or highest priority)? If we can decide on that, this can also be addressed? |
| Nokia | O1 or O2 | By default MUSIM gaps should have lowest priority compared to Type-2 gaps. So if NW does not assign priority to the MUSIM gap it should be considered as lowest priority than the Type-2 Gap priority values. |
| Apple | See Comment | As stated earlier, if UE supports priority for periodic gap, we exepct the NW to assign atleat a default priority level. We are not clear on what circumstances, NW will NOT assign any priority ? |
| ZTE | O2 is simpler | We think O2 is simpler at least from RAN2 aspect. |
| OPPO | Op2 | Op2 is simpler |
| Qualcomm | Other | Agree with Vivo and others that the NW should assign a priority for UEs which support requesting priority. |
| MediaTek | Other | We prefer to wait RAN4. If default priority (normal highest or lowest or whatever value) is needed, they can tell us. Otherwise, it could be just up to UE implementation. |
| DENSO | Other | Agree with vivo. |
| Ericsson | Others | Seems simplest nw always configures the priority.  Should discuss the case when supporting UE (Rel-18 MUSIM UE) interacts with Nw that does not support MUSIM gap priority setting. For this case a default (specified) behaviour is needed (and should be captured in RAN4 spec). “Lower priority than the Type-2 Gap priority values” as discussed by Nokia is probably fine. |
| Sharp | Others | We can wait RAN4 progress |
| Charter | Option 2 w/ comment | It seems the lowest priority value could be the same value as the default value except if the default is configurable by the NW. The solution lies between Options 1 and 2, if the default value is NW-configured, then default value can be used, otherwise the lowest priority value should be used. The question here is, which entity determines the default value? Is deault value set to 1…highest priority or 2…second level priority? |
| Xiaomi | Others | Agree with vivo. We can wait for more inputs from RAN4. |
| Samsung | Other | Check with RAN4 first |

Summary: *5 companies think that RAN2 can wait RAN4 progress; 2 companies think network will always configure priority levels to all configured periodic MUSIM gaps even if UE does not indicate preferred priority for one or some periodic MUSIM gaps. 1 company mentioned that it is not clear why it is optional for the UE to not indicate its preferred priority for a MUSIM gap in the preference indication. 1 company thinks network should assign at least a default priority level if UE supports priority for periodic gap. 4 companies agree with option 2; from these companies, 2 companies think Option 1 and Option 2 can work together. 1 company thinks that it is simple for network to always configure the priority. 1 company thinks we need to ask RAN4 on uncertain aspects from RAN2 point of view.*

*Based on above, the rapporteur thinks that we can just wait RAN4 progress on this topic or the following question needs to be checked with RAN4*

* *Does network always configure priority levels to all configured periodic MUSIM gaps if UE is allowed to indicate periodic MUSIM gap priority preference? If not, is there any need to specify a default UE behavior?*

**Proposal 7: RAN2 to discuss whether the following question needs to be checked with RAN4**

* ***Does network always configure priority levels to all configured periodic MUSIM gaps if UE is allowed to indicate periodic MUSIM gap priority prefernece? If not, is there any need to specify a default UE behavior?***

It is indicated in [13] that RAN4 is still discussing whether priority for aperiodic MUSIM gap needs to be introduced. In [5], it is proposed that RAN2 can indicate its preference to assign explicit priority for aperiodic gaps in RAN4 LS Response, considering that potential overlap between periodic MUSIM gaps and aperiodic MUSIM gap as well as between aperiodic MUSIM gap and NW-A Type-2 MG may occur. On the contrary, one company [8] mention that aperiodic MUSIM gap can be the highest priority implicitly.

**Q9: Which of the following options do you prefer for handling of aperiodic MUSIM gap priority preference/configuration?**

* **Option 1: wait RAN4 progress**
* **Option 2: assign explicit priority for aperiodic MUSIM gap**
* **Option 3: aperiodic MUSIM gap is the highest priority gap implicitly**
* **Others**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option(s) | Comments (if any) |
| vivo | Option 1 | We’d better wait RAN4 progress since they are discussing this. |
| Huawei/HiSilicon | Option 1 |  |
| Intel | Option 1 | As mentioned in the RAN4 LS below:  RAN4 is still discussing whether priority for aperiodic MUSIM gap needs to be introduced. |
| Nokia | Option 1 with comments | To have UE to have some preference for aperiodic gaps, we prefer to have priority for aperiodic gap. We can indicate the same in RAN2-LS indicating the cases where it will be beneficial. |
| Apple | Option 3 (See comments) | The reason we indicated aperiodic gaps to have the highest priority is because they are one time gaps. If for some reason, this gap gets scheduled out, UE has to re-request this gap again. This is not the case with periodic gaps, as they repeat in time domain. Our preference is to treat them at highest priority. At the same time, we understand this is for RAN4 to discuss and confirm. So in that sense option 1 for now is fine. |
| ZTE | Option 1 | This issue is also under RAN4 discussion, so we’d like to wait for RAN4’s RSP. |
| OPPO | Option1 |  |
| Qualcomm | Option 1 or 3 | It is okay to wait for RAN4 but RAN2 can also indicate a preference. Since aperiodic gap is a one time event that the UE will use for an important event, it is more reasonable to assign the highest priority. |
| MediaTek | Option 1 |  |
| DENSO | Option 1 |  |
| Ericsson | Option 2 | We agree with commets on that the aperiodic gap should likely have high priority, e.g. when the aperiodic gap is used for SIB reading from NW B. But also a gap for measurements could have high prio to trigger handover in Nw A. With the MUSIM gap preferences, full freedom is left to UE impl. It is a safe and simple approach for Nw to set the priority also for aperiodic gap, same as for periodic MUSIM gaps. |
| Sharp | Option 1 |  |
| Charter | Option 1 |  |
| Xiaomi | Option 1 |  |
| Samsung | Option 1 |  |

*Summary: 13 companies prefer Option 1; 1 company prefers Option 2; 1 company prefers Option 3.*

* *Among proponents of Option 1, it was mainly commented that RAN4 indicated in the LS that RAN4 is still discussing whether priority for aperiodic MUSIM gap needs to be introduced. 1 company thinks RAN2 can indicate the same in the reply LS i.e. RAN2 will also discuss the cases whether introducing priority for aperiodic MUSIM gap is beneficial or not; 1 company expressed that Option 3 is more reasonable.*
* *1 company prefers Option 2 since it is a safe and simple approach for Network to set the priority also for aperiodic gap, same as for periodic MUSIM gaps, though the aperiodic gap should likely have high priority.*
* *1 company prefers Option 3 because aperiodic MUSIM gap is one-shot gap so UE has to re-request it again if it gets scheduled out, but also pointed out that it is OK to wait RAN4 progress.*

*From RAN2 point of view, it seems hard to make any preference other than waiting RAN4 progress on this topic given that 2 companies among proponents of Option 1 expressed other views.*

**Proposal 8: Wait RAN4 progress whether/how gap priority is applicable to aperiodic MUSIM gap.**

### 3.2 RAN4 impacts on Maximum UL power change

In RAN2#121 meeting, The following agreement on maximum UL power change has made:

* 2: RAN2 considers that there may be RAN4 impact on the maximum UL power change due to R18 MUSIM. However, RAN2 needs to analyze the power issue more before asking RAN4 specifically.

Two companies suggest to study/analyze maximum UL power change due to R18 MUSIM operation from RAN2 perspective first. In [11], it is suggested to study when to trigger PHR given that UE reports PHR to NW A due to events occurred in NW B. In [5], it is proposed to support NW control on the uplink-power sharing for MUSIM operation (e.g. static and dynamic sharing mode) should be supported, which may require RAN4 analysis based on RAN2 conclusion.

On the other hand, three companies express that no RAN4 impact is expected from RAN2 point of view. In [2], it is mentioned that RAN2 does not need to study PHR triggering without any RAN4 input since how to calculate maximum UL power is defined in RAN4. In [9], similar view is stated and UE implementation can also handle the concerned scenario. In [5], the band conflict solution discussed in RAN2 can avoid any potential maximum UL power change issues without RAN4 involvement.

Based on companies’ views above, it is still not clear yet what exact RAN4 impacts (if any) are expected from RAN2 point of view. Thus, the rapporteur would like to ask the following question:

**Q10: Do you agree that “RAN2 assumes no RAN4 impact is expected on maximum UL power change due to R18 MUSIM. Can re-discuss if critical issues are found in RAN2”?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments (if any) |
| vivo | agree | RAN2 need not request RAN4 handling on maximum UL power change due to R18 MUSIM. Can re-discuss if critical issues are found in RAN2. |
| Huawei/HiSilicon | Agree |  |
| Intel | Agree |  |
| Nokia | See comments | How the concurrent transmission in NW-A and NW-B can be handled using PHR is not clear. There may be some delay in indicating PHR to NW that will have impact on transmission in other NW. Moreover how the power sharing works for other channels such as PUCCH and RACH in Dual active MUSIM operation also require some analysis. PHR cannot resolve this problem |
| Apple | Agree |  |
| ZTE | Agree |  |
| OPPO | Disagree | Currently, PHR is calculated for the activated Serving Cell, which is not suitable for R18 MUSIM case when USIM A is in RRC\_CONNECTED mode while USIM B is willing to enter RRC\_CONNECTED mode as USIM B is still in idle or inactive, so USIM A will not consider USIM B situation when reporting PHR, i.e. there is no room to consider the USIM B power requirements in idle or inactive according to the MAC spec, in this sense, legacy PHR procedure still does not solve the power sharing issue between USIMs. *5.4.6 Power Headroom Reporting* *The Power Headroom reporting procedure is used to provide the serving gNB with the following information:*  *- Type 1 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell;*  *- Type 2 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH and PUCCH transmission on SpCell of the other MAC entity (i.e. E-UTRA MAC entity in EN-DC, NE-DC, and NGEN-DC cases);*  *- Type 3 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for SRS transmission per activated Serving Cell;*  *- MPE P-MPR: the power backoff to meet the MPE FR2 requirements for a Serving Cell operating on FR2.* |
| Qualcomm | Agree |  |
| MediaTek | Agree |  |
| DENSO | Agree |  |
| Ericsson | Agree |  |
| Sharp | Agree |  |
| Charter | Agree |  |
| Xiaomi | Agree |  |
| Samsung | Agree |  |

*Summary: 13 companies agree with the proposal above. 2 companies do not agree with it, it was commented that existing PHR mechanism has some issues on* R18 MUSIM operation as follows:

* *There may be some delay in indicating PHR to NW-A that will have impact on transmission in NW-B*
* *Some analysis is required on how power sharing works for other channels (e.g. PUCCH and RACH) in dual active MUSIM operation*
* *Existing PHR mechanism is not suitable to the scenario in which USIM A is in RRC\_CONNECTED while USIM B is willing to enter RRC\_CONNECTED*

*Rapportuer understands that a majority of companies are not still convinced why/what any further RAN2 analysis is required due to dual active MUSIM operation. Since the proposal itself does not preclude further RAN2 discussion, it is suggested to follow a majority opinion.*

**Proposal 9: RAN2 assumes no RAN4 impact is expected on maximum UL power change due to R18 MUSIM. Can re-discuss if critical issues are found in RAN2.**

### 3.3 Others

For any **critical** other **stage-2** issues not covered above, please feel free to indicate them into the following table.

|  |  |  |
| --- | --- | --- |
| Company | Discussion points | Comments |
|  |  |  |
|  |  |  |

# 4 Conclusion

Proposals for easy agreements:

**Proposal 1: Introduce 1 optional per-UE capability bit (without xDD/FRx differentation) to indicate MUSIM gap priority configuration and preference. A UE supporting this feature shall also support *musim-GapPreference-r17*.**

**Proposal 2: Introduce a new indication in the *OtherConfig* to indicate whether UE is allowed to report MUSIM gap priority preference via UAI.**

**Proposal 4: The existing IE *GapPriority-r17* is re-used to configure the priority for periodic MUSIM gap.**

**Proposal 8: Wait RAN4 progress whether/how gap priority is applicable to aperiodic MUSIM gap.**

**Proposal 9: RAN2 assumes no RAN4 impact is expected on maximum UL power change due to R18 MUSIM. Can re-discuss if critical issues are found in RAN2.**

Proposals needed to be discussed online:

**Proposal 3: RAN2 to discuss how UE indicates periodic MUSIM gap priority preference**

* **Option 1: UE indicates an absolute priority for all or a subset periodic MUSIM gaps by taking into account of the Type-2 MG gap priority**
* **Option 2: UE indicates a relative priority for all or a subset periodic MUSIM gaps, i.e. the priority is relative just among the MUSIM gaps**
* **Option 3: wait RAN4 progress/feedback**

**Proposal 5: RAN2 to discuss how to configure the priority when network accepts gap priority preference for a periodic MUSIM gap**

* **Option A: Network configures the priority which is equal to the absolute value provided by the UE if Option 1 in Proposal 3 is agreed. FFS whether network can still change the absolute priorities while keeping the relative priorities among MUSIM gaps**
* **Option B: Network configures the priority which is aligned with the relative value provided by the UE.**

**Proposal 6: RAN2 to discuss whether to ask RAN4 on the same priority for periodic MUSIM gaps i.e. whether UE can report the same priority for different periodic MUSIM gaps and/or whether network can configure the same priority for different periodic MUSIM gaps.**

**Proposal 7: RAN2 to discuss whether the following question needs to be checked with RAN4**

* ***Does network always configure priority levels to all configured periodic MUSIM gaps if UE is allowed to indicate periodic MUSIM gap priority prefernece? If not, is there any need to specify a default UE behavior?***

# 5 Reference

[1] [R2-2303641](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303641.zip) MUSIM gap priorities Ericsson discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

[2] [R2-2303828](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303828.zip) Discussion on MUSIM gap priorities and maximum UL power change Samsung

Electronics Austria discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

[3] [R2-2302724](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2302724.zip) Remaining issues for MUSIM gaps Qualcomm Incorporated discussion

[4] [R2-2302783](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2302783.zip) Gap collision handling for Rel-17 gaps Intel Corporation discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

[5] [R2-2303190](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303190.zip) On MUSIM gap priority and uplink power sharing aspects of MUSIM operation Nokia,

Nokia Shanghai Bell discussion

[6] [R2-2303269](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303269.zip) Discussion on MUSIM gap priorities vivo discussion Rel-18

[7] [R2-2303352](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303352.zip) Discussion on MUSIM gap priorities Xiaomi discussion Rel-18

NR\_DualTxRx\_MUSIM-Core

[8] [R2-2303411](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303411.zip) Views on RAN4 LS for MUSIM gap priorities Apple discussion Rel-17

LTE\_NR\_MUSIM-Core

[9] [R2-2303471](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303471.zip) Discussion on MUSIM gaps and other RAN4 topics Huawei, HiSilicon discussion Rel-

18 NR\_DualTxRx\_MUSIM-Core

[10] [R2-2303875](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303875.zip) Consideration on the Scheduling Gap Priority ZTE Corporation, Sanechips discussion

Rel-18 NR\_DualTxRx\_MUSIM-Core

[11] [R2-2303937](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2303937.zip) Discussion on maximum UL power change for Dual Tx/Rx Multi-SIM ASUSTeK discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

[12] [R2-2304028](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2304028.zip) MUSIM Gap Priority LG Electronics discussion Rel-18 NR\_DualTxRx\_MUSIM-

Core

[13] [R2-2302430](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121bis-e/Docs/R2-2302430.zip) LS on priority for MUSIM gaps (R4-2303249; contact: vivo) RAN4 LS in Rel-18 NR\_DualTxRx\_MUSIM-Core To:RAN2