3GPP TSG-RAN WG2 #121 R2-xxxx

Athens, Greece, 27th February – 3rd March 2023

**Agenda item: 8.17.2**

**Source: vivo**

**Title:** **[AT121][202][MUSIM] LS to RAN4 on Rel-18 MUSIM impacts (vivo)**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion:

* [AT121][202][MUSIM] LS to RAN4 on Rel-18 MUSIM impacts (vivo)

      Scope: Discuss the topic and aim for consensus.

      Intended outcome: Summary in R2-2302008 and agreeable LS (if possible) to RAN4 in [R2-2302007](file:///C:\Users\terhentt\Documents\Tdocs\RAN2\RAN2_121\R2-2302007.zip).

      Deadline: Friday morning (before morning coffee break)

# 2 Contact Information

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Qualcomm Incorporated | Ozcan Ozturk (oozturk@qti.qualcomm.com) |
| Charter Communications Inc | Phillip Oni [c-phillip.oni@charter.com](mailto:c-phillip.oni@charter.com) |
| Xiaomi | Yumin Wu (wuyumin@xiaomi.com) |
| LGE | Hongsuk Kim (hassium.kim@lge.com) |
| Apple | Sethuraman Gurumoorthy (sethu@apple.com) |
| Lenovo | Lianhai(wulh5@lenovo.com) |
| vivo | Wenjuan Pu(wenjuan.pu@vivo.com) |
| Samsung | Sangyeob Jung (sy0123.jung@samsung.com) |
| Huawei/HiSilicon | Rama Kumar Mopidevi (rama.kumar@huawei.com) |
| ZTE | Li.wenting@zte.com.cn |
| DENSO | Tomoyuki Yamamoto (tomoyuki.yamamoto.j5c@jp.denso.com) |
| OPPO | fanjiangsheng@oppo.com |
| Ericsson | Hakan.l.palm@ericsson.com |
| Nokia | Srinivasan.selvaganapathy@nokia.com |
| Intel Corporation | Seau.s.lim@intel.com |

# 3 Discussions

During the RAN2 post email discussion R2-2300773, the potential RAN4 impact identified by the companies includes the interruption caused by UE capability switching, and the maximum UE power change.

**The interruption caused by UE capability switching:**

When the UE receives RRC reconfiguration or carrier deactivation in NW A which is a response to the UE’s capability restriction request, there is an interruption on the active carriers in NW A. This interruption is called interruption 1 in this offline. The interruption 1 follows the current RAN4 requirement.

There could be an additional interruption (called interruption 2) in NW A due to RF retuning for starting NW B activity, e.g., RRC connection setup procedure in NW B. The interruption 2 is different from that of RRC reconfiguration or carrier deactivation, and is not specified in RAN4. The interruption 2 could be close to the interruption 1, and for this case we can discuss whether new interruption requirement in NW A can be defined.



**Figure1**

**Observation 1: The interruption 2 in NW A may happen, and it is different from that of RRC reconfiguration or carrier deactivation, and it is possible/realistic to define the interruption 2.**

**Q1: Do you agree with the above OB1?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | | Comments | |
| See comment | | The interruption in NW A may be longer. However, the figure is not always accurate since the UE can do the NW B retuning in parallel with NW A reconfiguration and thus it is not always the sum of two interruptions. As always, the specification will define everything from NW A perspective. | |
| Charter – No | | UE performing RRC reconfiguration in NW A should not interrupt RF retuning in NW B, and these two activities can happen in parallel. | |
| Xiaomi | | No. We think that the RRC reconfiguration procedure with the legacy interruption requirements is already there workable for the legacy MUSIM UEs. We also think that the above two interruptions can be combined as one, and processed in parallel. | |
| LGE | | Maybe. However, this interruption time is the same as an interruption time that may be caused by any reconfiguration, including CA/DC modification, in cases where the CA/DC modification requires RF tuning. | |
| Apple – See Comment | | In our view, the Illustration is not fully correct. There could be some parallel tuning possible, but agree that some additional delay might be incurred (not necssarilly the absolute su of interruption 1 and interruption 2). | |
| Lenovo | | No. Processing reconfiguration message and RF retuning can be performed at the same time. | |
| vivo | | In our understanding, MUSIM UE will switch its capabilites after receiving the RRC reconfiguration, not in parallel. Otherwise, the UE’s configuration in NW A may exceed the UE’s current capabilities. And even if the RRC reconfiguration in NW A is in parallel with the RF retuning for activities in NW B, the interruption time may still longer than interruption 1.  Here is an example, assuming dual RX MUSIM UE received a paging or a request from the upper layer to initiate the RRC connection in NW B, the MUSIM UE may request to reduce 1 UL and 1 DL in NW A. When receiving the RRC reconfiguration to release one UL CC and one DL CC, the MUSIM UE needs to perform RF retuning. Currently, in RAN4 spec, from the NW A perspective, the interruption time is based on the longest SMTC of the all active CCs in the NW A, however it is not true at the UE side, since there is also active CC in the NW B. So, from our understanding, the interrution time in this case depends on the longest SMTC among all activated CCs in NW A and activated CCs in NW B). | |
| Samsung | | We think that it depends on UE implementation i.e. interruptions 1 and 2 can be done in paralell and. Of course, it can be done in sequential but we are under the impression that we don’t need to specify/define interruption 2 in the specification because we will define UE’s behavior from NW A perspective. | |
| Huawei/HiSilicon | | As commented by others, RF retuning and reconfiguration can be done in parallel depending on the UE implementation | |
| ZTE | We share the similar view as other companies that these two interruption can be happen paralelly, whether there would be some additional delay (e.g. for the case mentioned by Vivo) can be further discussed . | |
| DENSO | | It is possible, but RF retuning can be done in parallel as other compnies commented. | |
| OPPO | | Maybe have some extra interruption, but also something can be done in parallel, may need some RAN4 clarification. | |
| Ericsson | | We also share the view as other companies that these interruptions happen in parallel. | |
| Nokia | | We don’t see additional interruption due to the second MUSIM operation for RRC Reconfiguration. | |
| Intel | | We agree that it is possible to happen in parallel but it would be good to be analysed by RAN4 | |

**Q2: if the answer to Q1 is YES, do you think we should send an LS to RAN4 to ask if the interruption 2 in NW A due to MUSIM capability switching should be defined in RAN4?**

|  |  |
| --- | --- |
| Company | Comments |
| See comment | It is not clear how RAN4 can make an accurate assesment of this extended interruption since this depends on the configuration of NW B. |
| Charter – No | Agreed with QC, RAN2 should perform this assessment first since everything is being defined from NW A perspective. |
| Xiaomi | Agree with the above cqualomments from QC. |
| LGE | For this, we do not see any new RAN4 impacts. We think that RAN2 does not need to ask RAN4. |
| Apple | If we are defining this from NW A persepctive, |
| vivo | Yes. We think it would be good to have RAN4 input on this. |
| Samsung | We do not see any need to send an LS to RAN4 because we will only define/specify interruption 1. |
| Huawei/HiSilicon | if we end up sending an LS, may be we can ask RAN4 if it’s necessary to define interruption 2. |
| DENSO | No need to send LS about this. |
| OPPO | No harm to clarify this with RAN4 |
| Ericsson | No need to send LS about this. |
| Intel | We also do not see any harm in checking with RAN4. |

Whenever there is RRC reconfiguration in NW B, interruption may occur in NW A due to RF retuning at the UE. And this interruption time (called interruption 3 in this offline) is also not specified in RAN4. As the RRC reconfiguration in NW B may happen at any time and the interruption time depends on the configuration parameters involved, it is impossible to specify such interruption.



**Figure2**

**Observation 2: The interruption 3 in NW A may happen, and it is different from that of RRC reconfiguration or carrier deactivation, and it is impossible to define the interruption 3 because the uncertain time of the RRC reconfiguration in NW B and the involved configuration parameters.**

**Q3: Do you agree with the above OB2?**

|  |  |
| --- | --- |
| Company | Comments |
| Qualcomm | Yes. Agree that it will not be possible to assess and define interruption 3. |
| Charter – Yes | This is a valid concern. |
| Xiaomi | Yes |
| LGE | Maybe. This interruption time is the same as an interruption time that may be caused before sending the Capability Change Request to NW A. We agree that it may not be possible to define this interruption time. |
| Apple | Agree. It will be difficult to quantify the interruption 3 in NW A, as it depends on the configuraton on NW B. |
| Lenovo | Yes |
| vivo | Yes |
| Samsung | Yes |
| Huawei/HiSilion | Yes |
| ZTE | Yes |
| DENSO | Yes |
| OPPO | Yes |
| Ericsson | Yes |
| Nokia | When RRC connection is already active in both connections, UE is tuned to both network. For new carrier addition or deactivation in one of the USIM instance, how it impacts the ongoing operation is not clear. Do we expect some reduction in performance for short time during setup only. If this change impacts long time, UE can request for temporary capability restriction. |
| Intel | Yes |

**Q4: If the answer to Q3 is YES, do you think we should send an LS to RAN4 to confirm the above understanding?**

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| --- | --- |
| Company | Comments |
| Qualcomm | Not for this particular use case. If we end up sending an LS for other reasons, we should capture the RAN2 understanding that interruption 3 will not be specified. |
| Charter – No | Agreed with QC. We could try to understand in RAN2 if interruption 3 could be defined, if not we pass our understanding to RAN4. |
| Xiaomi | No strong view. We think that we should have a concrete use case for the interruption time (e.g. how to align the interruption time between the gNB and the UE), before sending an LS to RAN4. |
| LGE | No. This is because we think it's the same situation that the UE detect the conflicts before sending the Capability change request to NW A. We haven't seen the things that RAN4 needs to confirm so far since this is the legacy situation. |
| Apple | It is probably a bit early to send this LS. We might want to cosnider that RAN4 is currently working on R17 requirements and we might want to see the outcome of that. |
| Lenovo | No. After we have more RAN2 progress,to see if LS is needed or not. |
| vivo | We are fine with QC’s comments that if an LS is needed for other reasons, this understanding can be indicated to RAN4 in the LS. |
| Samsung | No |
| Huawei/HiSilicon | No need to include this case if we end up sending an LS. |
| ZTE | Share the same view with QC. |
| DENSO | No need to send LS about this so far. |
| OPPO | No need to send LS on this |
| Ericsson | No need to send LS on this |
| Nokia | No |
| Intel | Probably not since it is unclear when this interruption 3 will occur. |

**UL maximum power:**

Due to dual active transmission of R18 MUSIM, the maximum power may be constrained in NW A due to power sharing between NW A and NW B. And basically, this is RAN4 scope, so we think it would be better to get RAN4 input on this.

**Q5: Do you think we should send an LS to RAN4 to evaluate potential RAN4 impact for maximum power constraint for R18 MUSIM?**

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| --- | --- |
| Company | Comments |
| Qualcomm | Maybe. It would be easier to rely on PHR reporting. Changes to UL maximum power may depend on the band combinations across the two NWs and may require frequent signaling. Since PHR is always the most recent and accurate, it can solve the problem without any specification impact. |
| Charter – Yes | PHR reporting might be the way to go but LS should be sent to RAN4 for potential impact evaluation. |
| Xiaomi | We think that this power sharing issue can happen. However RAN2 should find a proper solution first, as what we did for the DC power sharing, before sending the LS to RAN4. Otherwise it would be difficult for RAN4 to define new requirements. If there is no RAN2 solution, we would consider that companies can raise their RAN4 solutions directly in RAN4. |
| LGE | Yes. As we commented in the previous email discussion, RAN2 cannot conclude this alone and RAN4 needs to analysis first for this. |
| Apple | Agree we need to work with RAN4 on this aspect. |
| Lenovo | LS may be needed for this case. |
| vivo | During the post email discussion, several companies think that RAN4 input is needed. We think better to send an LS to them. And if they confirm there is no RAN4 impact or they do not want to do any specification effort on this, we can delete the NOTE in the WID. |
| Samsung | There seems no harm to get RAN4’s input on this particular case. |
| Huawei/HiSilicon | No strong view. We think the current mechanism with PHR can solve the problem. |
| ZTE | We agree with Xiaomi that before sending the LS to RAN4, RAN2 should find a proper solution first, as what we did for the DC power sharing. |
| DENSO | Yes, we think LS should be sent for RAN4 impact evaluation. |
| OPPO | Yes, some clarification from RAN4 side can be helpful. |
| Ericsson | We agree with others that PHR can be used. We do not think there is a need to involve RAN4. |
| Nokia | Yes. Power sharing impacts needs to be analysed in RAN4 for simultaneous MUSIM operation |
| Intel | Yes, agree with the others that power sharing needs to be studied by RAN4 for dual TX MUSIM |