**3GPP TSG RAN WG1 #104-e R1-210xxxx**

**e-Meeting, January 25th – February 5th, 2021**

**Agenda item:** 8.1.1

**Source:** Moderator (Samsung)

**Title:** Moderator summary for

**Document for:** Discussion and Decision

## Introduction

In this summary, inputs from participating companies on the following DRAFT LS to RAN2:

[104-e-Post-R17-eMIMO-01] Email discussion for LS to RAN2 on TCI state update (beam indication) using non-serving source RS configured for non-serving cell(s) for DL reception and UL transmission – Eko (Samsung), Feb 22 ~ Feb 26

The following version of the companion DRAFT LS were provided:

* DRAFT R1-2102247 LS\_RAN2\_L12XCM BI (init): initial version
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## Summary

### Inputs on the initial version

Table 1 Companies’ inputs: initial

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| **Company** | **Input** |
| Apple | We suggest we clarify Q5 and Q6 a little bit. For Q5, RAN2 may not see the difference between inter-band CA and intra-band CA. For Q6, there may be different understanding on the definition of inter-frequency and intra-frequency.**Question 5**: In regard of inter-band CA issues, what would be the higher-layer impact assuming intra-band CA as opposed to inter-band CA? The unified TCI state introduced in Rel-17 associated with a non-serving cell is applied for CCs at least in a band.**Question 6**: In regard of inter-frequency issues, what would be the higher-layer impact assuming intra-frequency scenarios as opposed to inter-frequency scenarios? For intra-frequency scenario, it is assumed that SSBs of non-serving cells have the same center frequency and SCS as the SSBs of the serving cell.  |
| Ericsson | We do not see why this needs to go to RAN3 or RAN4.A relevant piece of information to include early is that RAN1 has agreed to support intra-DU scenarios.We suggest clarifying RAN1’s interpretation of “non-serving cell”:RAN1 is currently investigating TCI state update (beam indication) for DL reception from and UL transmission using non-serving reference signals – at least for UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH. A non-serving reference signal is a reference signal that is transmitted from a TRP broadcasting a PCI that is different than the serving PCI, i.e., the PCI in the servingCellConfigCommon. From RAN1’s point of view, such a TRP would correspond to a non-serving cell.We do not see that RAN1 needs any confirmation to proceed further. The LS is to inform RAN2 of the RAN1 work so that RAN2 can act accordingly:Overall, we do not see that RAN1 needs any information from RAN2 to progress the work. The LS is to explain and inform RAN2 about the work that we are doing. RAN2 can then act accordingly, as long as the correct explanation is provided. We suggest reformulating the questions into issues that may or may not require RAN2’s attention:During the discussions RAN1 has identified the following issues that may or may not require RAN2 attention:Issue 1: Aspects related to RRC reconfigurationThe procedures addressed by RAN1 (i.e., TCI state update) will not lead to any automatic updates of the RRC configurations, and RAN1 has discussed if such updates would be beneficial or needed. Two issues that have been discussed in particular are if the serving cell needs to be updated, and if it is viable to reuse the same C-RNTI over an area covered by multiple cells.Issue 2: Aspects related to the CU-DU splitRAN1 has agreed to support intra-DU scenarios. Issue 3: Aspects related to inter-band CAOne topic that is of particular interest in the FeMIMO WI is inter-band CA, and RAN1 is discussing if there are any particular aspects that should be considered in relation to beam indication.Issue 4: Aspects related to inter-frequency operationSo far, RAN1 has agreed to support intra-frequency scenarios, whereas inter-frequency scenarios have not been agreed. RAN1 is discussing if there are any particular aspects that should be considered in relation to beam indication.For the actions, we suggest:**ACTION:** RAN1 respectfully asks RAN2 to take the above information into account in their future work.  |
| Qualcomm | Some wording suggestions for the following sentencesAdd “can be” and “if supported”, since RS configured for the non-serving cell is not agreed yetAdd “s” after source RS, since the TCI state can have two RSsRAN1 is currently investigating TCI state update (beam indication) for DL reception from and UL transmission to non-serving cell(s) – at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH. In this case, the TCI ~~is~~ can be associated with ~~a~~ source RS(s) configured for the non-serving cell(s) if supported. To our understanding, selecing pre-configured values is one way to avoid RRC reconfig, so suggest to add it in the example.**Question 1**: In regard of RRC configuration:1. Is RRC reconfiguration signaling needed for DL reception from or UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, which parameter(s)?
2. Can some RRC parameters related to the non-serving cell(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI, potentially selecting pre-configured values) without any additional RRC reconfiguration signaling?
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| MediaTek | Regarding the question 1, we think the point is whether any RRC paranmeter update is needed for DL reception from and UL transmission to non-serving cell(s). Then, if the answer is yes, it is clear for us that the RRC paranmeter(s) can be updated by RRC reconfiguration signaling. However, what we want to know is whether the RRC paranmeter(s) can be updated without RRC reconfigurtion signaling, and the 2nd sub-bullet can be used for clarify it. In summary, we suggest the following changes: **Question 1**: In regard of RRC configuration:1. Is RRC paramter(s) needed to be updaed for DL reception from or UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, which parameter(s)?
2. If RRC paramter(s) updae is needed for DL reception from or UL transmission to a non-serving cell, can the RRC parameter(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI) without any additional RRC reconfiguration signaling?
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| vivo | For Question1, our understanding is that Question1 is dependent on the answer for Question2. If there is no motivation to change serving cell, we don’t think it is necessary to further discuss Question1. For the case when the serving cell is not changed, wethere some other RRC parameters need to be updated is independent of which TCI state is indicated. Thus we would like to switch the order of Question1 and Question2. And change the corresponding questions as following:

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| Question 1: In regard of serving cell, is a UE expected to change its serving cell for DL reception from or UL transmission to another (i.e. a non-serving) cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, what would be the higher-layer impact?Question 2: If the answer to Question 1 is yes, in regard of RRC configuration:1. Is RRC reconfiguration signaling needed for DL reception from or UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, which parameter(s)?
2. Can some RRC parameters related to the non-serving cell(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI) without any additional RRC reconfiguration signaling?
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For the following question, is the intention to compare the difference between inter-DU and intra-DU case?

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| Question 4: In regard of CU-DU split, by restricting the above feature only for intra-DU scenarios (instead of allowing inter-DU scenarios as well), what would be the difference in terms of the following compared to allowing inter-DU scenarios as well? 1. The associated RAN2 specification impact
2. The implication in applicable use cases and inter-operability (e.g. across different gNB vendors)
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For Question 5, we would like to make the questions more general rather than directly asking the spec impact.

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| Question 5: In regard of inter-band CA issues, are there any specific issues that need to be considered assuming intra-band CA as opposed to inter-band CA? |

For Question 6 we would also like to highlight that only intra-frequency case is agreed. We are fine with E///’s wording.

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| **Question 6**: In regard of inter-frequency issues, RAN1 has agreed to support intra-frequency scenarios, whereas inter-frequency scenarios have not been agreed. Are there any specific issues that need to be considered assuming intra-frequency scenarios as opposed to inter-frequency scenarios?  |

We think RAN4 may also need to be involved at least for Question 5 and Question 6.  |
| Nokia/NSB | We first have the following update on the receipients of the LS, due to the reason that CU-DU-split is in RAN3 domain, so better ask for RAN3 to provide view on that and also RAN could be in CC for information since this may impact TU discussions.

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| **To:** RAN2, RAN3, RAN4**Cc:** RAN |

We respect to the text, we have the following suggestions. First, we see a need to add a question w.r.t the TCI, the point being that is it feasible from RAN2 POV that UE does measurements (e.g. L1-RSRP, L3-RSRP) for TCI state updates for the non-serving cell?

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| **Question 0**: With regards to TCI state measurements, is it feasible from RAN2 viewpoint that network could request UE to provide measurements used for TCI state updates for both serving cell and non-serving cell? |

On question1, in addition to some text edits, we think it might be good to ask if RAN2 sees difference if UE was configured for 1) PDSCH, 2) PDCCH+PDSCH, 3) PUSCH, 4) PUCCH+PUSCH, 5) PxSCH, 6) PxCCH+PxSCH?

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| **Question 1**: In regard of RRC configuration:1. RAN1 is discussing whether to allow UE to be configured to receive DL from or transmit UL to a non-serving cell, on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH. What kind of impacts does RAN2 see for allowing UE to receive some or all of these channels and which parameter(s) would need to be configured for the UE to allow this?
2. Does RAN2 see it feasible that some RRC parameters related to the non-serving cell(s) could be updated via dynamic signaling (e.g. MAC CE and/or DCI) without any additional RRC reconfiguration signaling (i.e. changing the parameters would only require MAC CE and/or DCI indication)?
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| **Question 2**: How can the addition, release or change of a non-serving cell for DL reception and/or UL transmissionbe done? E.g. if UE is configured to additionally receive DL from or transmit UL to the non-serving cell, what would be the higher-layer impacts? Would any of these actions require (intra-cell) handover from RAN2 perspective? |

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| **Question 3**: In regard of C-RNTI:1. Is UE required to have separate C-RNTI for DL reception from and UL transmission to the non-serving cell, or can the same C-RNTI as used for the serving cell be reused?
2. If separate C-RNTI is required for serving and non-serving cells, how would this be configured for UE, i.e. is RRC reconfiguration signaling or some other (dynamic) signaling needed for the C-RNTI update?
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| **Question 4**: In regard of CU-DU split, ). From RAN2/3 perspective, are there any differences if only intra-DU or both intra-DU and inter-DU are supported in terms of the following? 1. The associated RAN2/3 specification impact
2. Applicable use cases (e.g. deployment scenarios) and
3. Network inter-operability (e.g. across different gNB vendors)
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| **Question 5**: RAN1 has discussed that the operation could be supported for intra-band CA scenario (i.e. UE is configured to operate with serving and non-serving cells that correspond to intra-band CA band combination that UE supports) or for both intra-band CA and inter-band CA scenarios. In regard to these scenarios, what kinds of higher-layer impacts does RAN2/4 foresee if the feature was supported in intra-band CA scenarios only or if it was supported in intra-band CA and inter-band CA scenarios? |

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| **Question 6**: RAN1 has discussed that the operation could be at least supported for intra-frequency scenario (i.e. both the serving and non-serving cell are operating under the same center frequency and SCS) and suppport of inter-frequency scenario is FFS. In regard to these scenarios, , what kind of higher-layer impacts does RAN2/4 foresee in intra-frequency scenarios only or if it was supported in both intra-frequency and to inter-frequency scenarios?  |

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| **2. Actions:****To: RAN2****ACTION:** RAN1 respectfully asks RAN2 to provide answers for the above questions related to signalling or connection control procedures with additional details that RAN1 shall further consider.**To: RAN3****ACTION:** RAN1 respectfully asks RAN3 to provide answers for the above questions related to CU-DU split with additional details that RAN1 shall further consider. |

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| Intel | We want to better understand the intention of this LS from RAN1 perspective since some of the questions require actual solution based on further discussion in RAN2. Since RAN2 is not working on this topic currently, what would be the expectation from RAN1 i.e., do we wait for concrete feedback till RAN2 starts work and not discuss the related topics in RAN1 any further?Additionally, if we go with Ericsson’s suggestion of simply informing RAN2, do we still continue discussing support of RRC reconfiguration, C-RNTI update, inter-DU and inter-frequency use cases in RAN1? Generally, we feel that this should be a RAN2 led topic rather than RAN1 making decisions with major RAN2 specification impact. |
| Futurewei | We are in general ok with the questions in this LS. Since the answers to Questions 1 (RRC reconfiguration) and 3 (C-RNTI update) may be dependent on the answers to Question 2 (serving cell change), we agree with Vivo that the order of the questions should be re-arranged. Therefore we would like to suggest the following changes: **Question 1**: In regard of serving cell, is a UE expected to change its serving cell for DL reception from or UL transmission to another (i.e. a non-serving) cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, what would be the higher-layer impact?**Question 2**: In regard of RRC configuration:1. Is RRC reconfiguration signaling needed for DL reception from or UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, which parameter(s)?
2. Can some RRC parameters related to the non-serving cell(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI) without any additional RRC reconfiguration signaling?

**Question 3**: In regard of C-RNTI:1. In what condition(s) does a UE require C-RNTI update for DL reception from and UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH?
2. In such condition(s), if any, is RRC reconfiguration signaling or some other (dynamic) signaling needed for the C-RNTI update?
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| Samsung | In RAN1#104-e, issues were raised and discussed relating to the need for RRC configuration, the need for C-RNTI change, inter-band CA issues, intra-band CA issues, etc …. The purpose of this LS is to solicit feedback from RAN2 on these open questions otherwise we continue discussing in RAN1 without much progress. Therefore, in the action section, we should clearly state that “we respectfully request RAN2 to provide feedback”. This LS is not just for RAN2’s information, but for benefit of RAN1 to get the information we need to progress.We are fine with the contents and questions in the LS. It is fine to switch the order of questions 1 and 2 as proposed by vivo and Futurewei. We agree with Qualcomm that RAN1 has not agreed on support of TCI states configured with non-serving cell RS. Therefore, we agree to change “is” to “can be”. Regarding Ericsson’s comment, it is true that RAN1 has agreed on intra-frequency in RAN1#103-e. But RAN1 has not agreed on support of intra-DU or inter-DU L1/L2-centric mobility. The agreement includes it as an FFS.**Agreement**On Rel-17 enhancements to enable L1/L2-centric inter-cell mobility: * The following use cases are assumed:
	+ Network architecture:
		- NSA, i.e. LTE PCell and NR-PSCell
		- SA
	+ Intra-band CA
		- FFS: If inter-band CA is also included
	+ Intra- RAT (excluding inter-RAT)
	+ Intra-frequency scenario:
		- The SSBs of non-serving cells have the same center frequency and SCS as the SSBs of the serving cell
		- An SSB of a non-serving cell is associated with a PCI different from the PCI of the serving cell
		- FFS: Support for inter-frequency scenario
	+ FFS: Whether to support intra-DU only operation, or whether inter-DU is also allowed

Finally, we see some overlap with item 2b “QCL/TCI-related enhancements to enable inter-cell multi-TRP operations”. Therefore, some of the issues raised in LS could be applicable to item 2b. We could update the LS to include 2b:As a part of the Rel-17 NR\_FeMIMO WID wherein the group is tasked to “identify and specify features to facilitate more efficient (lower latency and overhead) DL/UL beam management to support higher intra- and L1/L2-centric inter-cell mobility” as well as “QCL/TCI-related enhancements to enable inter-cell multi-TRP operations”, RAN1 is currently investigating TCI state update (beam indication) for DL reception from and UL transmission to non-serving cell(s) – at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH. In this case, the TCI is associated with a source RS configured for the non-serving cell(s). |
| Sony | First of all, it seems reasonable to switch Q1 and Q2 as mentioned by vivo and others, since serving cell change may result in RRC reconfiguration. vivo’s version looks good to us. For Question 1 (Item 2), in our understanding, RRC parameters follows the ASN.1 rule which is surely in different format from MAC CE or DCI. Our question would be that is such dynamic signaling based on RRC pre-configuration on a few of cells including serving cell(s) and non-serving cell(s)? If yes, we would like to try the following modification. 1. Can some RRC parameters related to the non-serving cell(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI) based on RRC pre-configuration but without any additional RRC reconfiguration signaling?

For Qestion 3 (Item 2), since in current spec TS 38.321, C-RNTI can be updated per MAC entity by MAC CE. From latency and realiableiy perspective, it seems not necessary to apply RRC reconfiguration to update C-RNTI, so we would like to try following change too 1. In such condition(s), if any, is MAC CE or some other (dynamic) signaling needed for the C-RNTI update?

Finally, considering the status of RAN2 TU budget, we would like to confirm that even without RAN2’s answers or responses, RAN1 may continue the study/discussion in RAN1’s region, e.g. L1 measurement, L1 reporting |
| Huawei, HiSilicon | Q1: We are not sure if the first part is really needed. In our reading, if a UE is not currently configured to receive from non-serving cell, RRC reconfiguration would naturally be needed; if a UE has been pre-configured for reception from several candidate non-serving cell(s), RRC reconfiguration seems not needed for picking up reception from one of the previously configured non-serving cell (and the WID explicitly says ‘as opposed to RRC’). Q2: Whether the UE should change the primary serving cell depends on the design in RAN1 and RAN2. In our view, it would make more sense to ask RAN2 about the feasibility of not-changing the primary serving cell if all or part of UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH are switched to a non-serving cell (as changing the primary serving cell completely is already possible with L3 handover), or the feasibility of changing the primary serving cell via dynamic signaling such as MAC-CE and/or DCI. Q3: The question is formulated obviously biased towards C-RNTI update. We suggest rephrasing it in a question form such as ‘whether C-RNTI update is needed for DL reception from and UL transmission to a non-serving cell’. Q4: After checking with our RAN2/RAN3 colleagues, our understanding is allowing for inter-DU case would have RAN3 impact, and we suggesting copying RAN3 for them to check. Q5: To us, it would make more sense to ask what the addtiaionl higher-layer impact is when inter-band CA is supported in addition to intra-band CA (agreed). In our understanding, if similar design as traditional L3 handover is considered, the SCell(s) would be released upon changing primary serving cell. In this case, a relevant question that we may need to ask RAN2 would be whether it is feasible and how to keep the SCell(s) alive if the primary serving cell is to be changed. Q6: Again, to us, it would make more sense to ask what the addtiaionl higher-layer impact is when inter-frequency scenario is supported in addition to intra-frequency scenario (agreed). |
| OPPO | In general, the list of questions in the LS draft look ok. It is necessary to get answers from RAN2/RAN3 on those question for our design in RAN1.One comment is that those questions seem to be relevant to the inter-cell mTRP too. In inter-cell mTRP, the UE also receives PDSCH and PDCCH from one neighbor non-serving cell. Thus, suggest the update following paragragh by including the inter-cell mTRP:For ~~this purpose~~ the L1/L2-centric inter-cell mobility and inter-cell mTRP, RAN1 seeks a few answers from RAN2 on the following questions in order to proceed further. Particularly for Question 2: We shall also figure out what shall the UE do to the previous serving cell and those TCI states associated with previous serving cell if the UE changes the serving cell when being indicated with non-serving cell TCI states. All those ‘normal’ TCI states seems to become TCI state asscoaited with a non-serving cell now after the UE changing the serving cell. Furthermore, what is the impact on receiveing system information. For instance, does the UE need to receive system information from the non-serving cell? And does the UE stop receiving system information from previous serving cell?**Question 2**: In regard of serving cell, is a UE expected to change its serving cell for DL reception from or UL transmission to another (i.e. a non-serving) cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, what would be the higher-layer impact? And if so, how to deal with the previous serving cell and the TCI states associated with previous serving cell? Any impact on UE receiving system information. |
| LG | We sympathize Ericsson’s comment that it would be better to clarify the meaning of ‘L1/L2-centric inter-cell mobility’ and ‘non-serving cell’ from RAN1/MIMO perspective as these terminologies have quite different meaning for RAN2. In addition, we think that explanation of background of these questions is needed before asking RAN2’s opinion. For example, the text provided by Ericsson ‘The procedures addressed by RAN1 (i.e., TCI state update) will not lead to any automatic updates of the RRC configurations, and RAN1 has discussed if such updates would be beneficial or needed. Two issues that have been discussed in particular are if the serving cell needs to be updated, and if it is viable to reuse the same C-RNTI over an area covered by multiple cells.’ can be added for Q1~Q3. Some explanation of RAN1 discussion for Q4~Q6 seem to be needed as well. |
| ZTE | Firstly, we share the same views with Nokia that this LS should be sent to RAN3 and RAN4 as well, considering that inter/intra-DU at Q3 is relevant to RAN3 and inter/intra-frequency at Q5 is relevant to RAN4. Some update in Section 2 Action to RAN3/4 is needed accordingly.Q1: In our views, this question in first sub-bullet is to identify which RRC parameters should be updated/reconfigured due to switching to non-serving cell, rather than reusing the common parts for current serving cell. Then, we would like check RAN2 views on whether the idenfied RRC parameter can be updated by dynamic signaling. If so we suggest to slightly change the first sub-bullet as follows, in order to avoid some ambiguities:

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| **Question 1**: In regard of RRC configuration:1. Are RRC parameters needed to be reconfigured for DL reception from or UL transmission to a non-serving cell, at least on UE-dedicated PDSCH, PDCCH, PUSCH, and PUCCH? If so, which parameter(s)?
2. Can some of the above RRC parameters related to the non-serving cell(s) be updated via dynamic signaling (e.g. MAC CE and/or DCI) without any additional RRC reconfiguration signaling?
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 Q2: We slightly prefer to go with Nokia’s updated version, considering that RAN2 clarification on procedure of switching a serving cell to a non-serving cell is necessary for RAN1 following discussion.Q5: In our views, the clarification for intra-band updated from some companies seems not to be needed.Q6: This question is also relevant to RAN4. Also we would like to split the case of inter-frequency into inter-ferquency within an active BWP and inter-frequency outside active BWP, considering that the UE behavior of inter-frequency within an active BWP is similar to intra-frequency.

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| **Question 6**: In regard of inter-frequency issues, what kind of the higher-layer impacts does RAN2 and RAN4 foresee assuming inter-frequency scenarios (within an active BWP or outside an active BWP) as opposed to intra-frequency scenarios?  |

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| Ericsson2 | We share the views of Intel that we need to understand the intention of the LS better. Overall, it would seem appropriate to discuss RAN2 issues in RAN2, and at least some of the questions are in RAN2’s domain. Avoiding discussions in RAN1 on these topics is a good idea, and with a RAN2 LS, we would hand over these discussions to RAN2. This is an important motivation of the LS. In addition, the LS gives RAN2 a heads-up to find other issues, not identified by RAN1. We would be surprised if there are no such issues.What we fail to see is how any RAN2 feedback would impact the work in RAN1. For example, the first question is if RRC configuration is needed. The answer could be ‘no’ – in which case there is no impact on RAN1 work. The answer could be ‘yes’ – in which case there is also no impact on RAN1 work, but it could impact the work in RAN2. So why would RAN1 need a response to progress our work?There are several examples in the questions on the higher layer impact. It would make sense to inform RAN2 that RAN1 has identified a potential higher layer impact, but why would RAN1 need to know? If there is (significant) higher-layer impact, RAN2 would have to specify the required functionality.Thanks Emad for spotting the intra-DU issue – our interpretation was that the FFS was if we should support intra-DU or intra+inter-DU, but that is not the only interpretation.We reiterate that the most important part of the LS is to explain how RAN1 has interpreted the statements in the WID on L1/L2-centric inter-cell mobility. Without that interpretation, it is very difficult for RAN2 to provide any answers. This should be made clear: from a RAN1 point of view, a non-serving cell is a TRP that broadcasts another PCI.In the agreement it is stated that the LS should go to RAN2. We suggest sticking to the agreement. |

Observation/summary: ....

### Inputs on revised version