**3GPP TSG-RAN WG2 #113-e *R2-210xxxx***

**E-meeting, January 2021**

Agenda Item: 8.7.4

Source: OPPO

Title: Summary document of AI 8.7.4

Document for: Discussion, Decision

# Introduction

This is for the summary of documents submitted / related to AI 8.7.4.

# Discussion

## Questions for Easy Proposals

In [1], it is proposed to solve the left editor-note in the TR for U2U relay as follows

*Editor note: RAN2 will strive for a common solution to the in- and out-of-coverage cases.*

[…]

*Editor note: RAN2 will strive for a common solution between same cell and different cell cases for this scenario. If a common solution is not possible and impacts are found to supporting different cell case, RAN2 works on the same cell case with higher priority.*

**Q1-1: Do you agree to move the note “ *Editor note: RAN2 will strive for a common solution to the in- and out-of-coverage cases.*” into normative text?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree |  |
| Qualcomm | Agree |  |
| Lenovo, MotM | Agree |  |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree |  |

**Q1-2: Do you agree to remove the note of “*Editor note: RAN2 will strive for a common solution between the same cell and different cell cases for this scenario. If a common solution is not possible and impacts are found to supporting different cell case, RAN2 works on the same cell case with higher priority.*”?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree |  |
| Qualcomm | Agree |  |
| Lenovo, MotM | Agree |  |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree |  |

In [18], it is proposed to consider different criterion for selection between direct and indirect link(s). While in [16], it is proposed to adopt LTE solution to prioritize direct link if Uu link quality is above a threshold.

**Q1-3: Do you agree that as in LTE, an in-coverage remote UE searches for a candidate relay UE if direct Uu link quality of the remote UE is below a configured threshold?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree |  |
| Qualcomm | Agree | We prefer to reuse LTE solution |
| Lenovo, MotM | Agree with comment | Yes if search = discovery, but PC5 RRC Connection need not be established until the UE has data to send. |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree |  |

In [22], it is proposed to add the SA2 conclusion into RAN2 TR, i.e., for L3 U2U relay, according to TR 23.752

- UE-to-UE Relay discovery and selection are supported by:

- Model A discovery (as described in sol#11);

- Model B discovery (as described in sol#8); and

- Integrated PC5 unicast link establishment procedure (as described in sol#8).

[…]

* The relay reselection can be viewed just like redoing the relay selection as described in Sol#8 or be performed as described in Sol#50. The reselection criteria are to be coordinated with RAN2 WG.

While for L2 U2U relay

- For Relay reselection, the negotiated UE-to-UE Relay reselection in Sol#50 and the Relay selection in Sol#8 can be used under different conditions. Both Sol#50 and Sol#8 can be taken as baseline.

So SA2 has converged on solution #8 and #50 for both L2 and L3 relay **re**selection, while the solution for relay selection is only clarified for L3 relay as #8 and #11 but not for L2 relay.

**Q1-4: Do you agree to capture in RAN2 TR that Solution#8 and Solution#50 are taken as baseline solution for L2 and L3 UE-to-UE relay reselection, and solution#8 and solution#11 are taken as baseline solution for L3 UE-to-UE relay selection?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree |  |
| Qualcomm | Agree | It is aligned with our understanding of SA2 conclusion on relay (re)selection |
| Lenovo, MotM | Agree | Solution#8 and Solution#11 can work. Solution#50 can lead to some AS issues. |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | No strong view | Minor wording suggesting:” **to capture in RAN2 TR that R2 understand, as in SA2 TR, xxxx**”.This is to clarify we didn’t change anything of SA2. |

## Questions which Have Been Discussed/Concluded

In [6][12][15], for U2N relay, it is proposed to adopt a mixed direct/indirect scenario for the in-coverage remote UE, e.g.,

* Split CP and UP on direct and indirect path respectively;
* Deliver UP on direct and indirect path simultaneously (e.g., according to whether they are delay sensitive or not);
* Deliver CP on direct and indirect path simultaneously (e.g., with duplication or not);

On the other hand, rapporteur observes that the opposite proposal has been discussed in RAN2#111 in R2-2008264 with clear majority support. From rapporteur perspective, for U2N relay, we can go for the majority view.

Revised Proposal 11: For UE to NW relay, RAN2 assumes the remote UE has an active end-to-end connection via only a single relay UE or via Uu at a given time. The remote UE can have a direct Uu connection or a connection via a single relay UE, but these two connections should not be active at the same time. Mechanisms for ensuring service continuity (e.g. during path switch) are not precluded.

**Q2-1a: Do you agree no need for in-coverage remote UE to support simultaneous direct (via Uu) and indirect (via PC5 through a L2 UE-to-Network Relay UE)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Not-agree | The direct link to gNB is legacy behaviours, no too much effort is needed. It can be easier adopted. |
| Qualcomm  | Agree | If it is allowed, it means the remote UE needs to support dual connectivity of Uu and PC5 for L2 relay because both links are terminated in same gNB. It will bring many issues and new requirements. For example, considering we don’t have RAN4 TU on sidelink relay, how can RAN2 determine the RAN4 requirement of PC5+Uu DC? Given we have identified a lot of issues to resolve in WI phase, we recommend RAN2 to consider it in future release. |
| Lenovo, MotM | Not-agree | We need a solution that works, and we do not see how one-path-at a time can help in RLF situation. Since the central idea of the Study is Coverage Extension/ Reliability, any hurried agreements will do long term damage. RAN2 needs to invest some time to think here; we have sufficient time for work phase. |
| Samsung | Agree | We prefer to focus on baseline scenario in this release i.e., one termination point via either direct link or indirect link. |
| OPPO | Agree | Although the benefit has been clarified as above, our assessment is this goes beyond the capacity of WI in this release. |
| Huawei | Postpone to WI phase | Clearly this is enhancement. We can consider this in the WI later phase to check if this can be easily achieved with minor spec impact, when we have the clear views on the basic solution.  |

**Q2-1b: Do you agree for in-coverage remote UE, whether to support simultaneous direct (via Uu) and indirect (via PC5 through a L3 UE-to-Network Relay UE) is out of RAN2 scope?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree | For L3 case, it is out of RAN2 scope. |
| Qualcomm | Yes…(see comments) | In our understanding, simultaneous PC5 and Uu operation has been supported in Rel-16 NR V2X: a sidelink UE can simultaneously have Uu transmission with gNB and PC5 transmission with another sidelink UE. For L3 relay, because remote UE is not visible to gNB, the Uu link and PC5 link are not terminated in same gNB. Thus, we think it is same as simultaneous PC5 and Uu operation in Rel-16 NR V2X.To avoid further controversial discussion in last meeting of SI phase, we can accept if it is agreed as “out of RAN2 scope” as Rapporteur suggested, or no agreement is made. We don’t accept agreement that such operation is not allowed for L3 U2N relay.  |
| Lenovo, MotM | Not-agree | The Study (RP-193253) clearly requires coverage extension – and using multi-path diversity is one of the main tools available to RAN2/ 1. It can’t be out of scope for us. |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Not agree | The aspect on CP link between remote UE and gNB is R2 scope. Yet, we have no conclusion on this, which is pretty essential. |

In [15], similar proposal is proposed for U2U relay as well.

On the other hand, rapporteur observes that the opposite proposal has been discussed in RAN2#111 in R2-2008264 with clear majority support (20 out of 25 select option-a)). From rapporteur perspective, for U2N relay, we can go for the majority view.

Question 14: Which connectivity scenarios should be supported for the source UE in UE to UE relaying?

a) Active link to the target UE either directly or via a relay UE, but not both

b) Active link with a target UE both directly and via a relay UE

c) Active links with a target UE supported via different relay Ues

d) Active links with two different target Ues via two different relay Ues

**Q2-2a: Do you agree no need for source UE to support simultaneous direct (connecting to destination UE directly) and indirect (through a L2 UE-to-UE Relay UE)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Not-agree | b), c) should be supported. |
| Qualcomm | Agree | Same comments to Q2-1a, we recommend RAN2 to consider it in future release. |
| Lenovo, MotM | Not-agree | We need a solution that works, and we do not see how one-path-at a time can help in RLF situation. Since the central idea of the Study is Coverage Extension/ Reliability, any hurried agreements will do long term damage. RAN2 needs to invest some time to think here; we have sufficient time for work phase. |
| Samsung | Agree | Same as Q2-1a |
| OPPO | Agree | Although the benefit has been clarified as above, our assessment is this goes beyond the capacity of WI in this release. |
| Huawei | Postpone to WI phase |  |

**Q2-2b: Do you agree whether source UE supports simultaneous direct (connecting to destination UE directly) and indirect (through a L3 UE-to-UE Relay UE) is out of RAN2 scope?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree | For L3 case, it is out of RAN2 scope. |
| Qualcomm | Yes..(see comments) | Same comments to Q2-1b, although we think it is already supported in NR Rel-16 (i.e. one sidelink UE can have simultaneous connection with two other sidelink UEs), we can accept if it is agreed as “out of RAN2 scope” as Rapporteur suggested, or no agreement is made. We don’t accept agreement that such operation is not allowed for L3 U2U relay. |
| Lenovo, MotM | Not-agree | The Study (RP-193253) clearly requires coverage extension – and using multi-path diversity is one of the main tools available to RAN2/ 1. It can’t be out of scope for us. |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Not agree | The PC5 RRC connection is R2 scope. We may need to clarify if there is still PC5 RRC connection allowed in direct link between those two UEs, in addition to the relayed link. |

There are some papers that raises additional factors to take into account for relay (re)selection, e.g., Relay load [7], MCR [17], serving cell and RRC state of relay UE[18], “Failure” indication from relay UE [7][21], where the former one may include impact on discovery message content design.

Additionally, rapporteur would like to point out the following agreement from RAN2#112

Proposal 12 [Easy]: Additional AS layer criteria can be considered in WI phase for both Layer 2 and layer 3 U2N relay solutions.

**Q2-3: Given the agreement as above, do you agree no need to further discuss the other additional factors (e.g., Relay load [7], MCR [17], serving cell and RRC state of relay UE[18], “Failure” indication from relay UE [7][21]) for U2N relay in study phase?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree | We should discuss additional AS layer criteria in WI phase |
| Qualcomm | Agree | We should respect the agreement we made in RAN2#112-e |
| Lenovo, MotM | Agree if it can be discussed in WI. | Our understanding of the proposal is that can be directly worked at in the WI phase. |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree to postpone to WI phase |  |

For UE-to-UE relay, when source UE performs relay selection, it is proposed to take the 2nd hop (between relay UE and destination UE) signal quality into account [7][10][21].

Based on the observation by rapporteur, SA2 has agreed on both discovery model-A/B for the U2U relay, and this is also related to discovery message content design which relates to SA2 scope. Also, rapporteur would like to point out the following agreement from RAN2#112

Proposal 14 [Easy]: Additional AS layer criteria can be considered in WI phase for both Layer 2 and layer 3 U2U relay solutions.

**Q2-4: Given the agreement as above, do you agree no need to discuss if the link quality between the relay UE and destination UE should be considered by source UE to (re)select relay UE in study phase?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree | We should discuss additional AS layer criteria in WI phase |
| Qualcomm | Agree | We should respect the agreement we made in RAN2#112-e |
| Lenovo, MotM | Agree |  |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree to postpone to WI phase |  |

Considering that signal strength of both discovery message and unicast link can act as base for relay (re)selection, there are some discussion on how to select between the two in different cases.

In [8], it points out the RSRP measurement may be hard if the relay and remote UE are not continuously exchanging messages over the link. In [7], to address the similar issue, it is proposed to rely on data availability.

Proposal 2: Relay reselection is triggered based on only SL-RSRP of data, if data is available at the remote UE.

Proposal 3: If the data has not been available at the remote UE for some time, the remote UE triggers reselection based on discovery RSRP.

While in [16], the proposal is in the opposite direction

Proposal 1: Remote UE only use SL-RSRP to evaluate whether PC5 link quality with a relay UE satisfies relay reselection criterion when the remote UE has PC5-RRC connection with the relay UE.

And rapporteur would like to point out the following agreement from RAN2#112

Proposal 3: Remote UE may also use SL-RSRP measurements on the SIdelink unicast link to evaluate whether PC5 link quality with a relay UE satisfies relay reselection criterion. Details e.g. in case of no transmission on the unicast link can be discussed in WI phase.

**Q2-5: Given the agreement as above, do you agree how to perform RSRP measurement based on RSRP of discovery message and/or SL-RSRP if remote UE has PC5-RRC connection with relay UE can be decided in WI phase?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| MediaTek | Agree |  |
| Qualcomm | Agree | We should respect the agreement we made in RAN2#112-e |
| Lenovo, MotM | Agree |  |
| Samsung | Agree |  |
| OPPO | Agree |  |
| Huawei | Agree to postpone to WI phase |  |

## Questions for New Proposal

In [4], it is proposed that RAN2 discuss whether remote/relay UEs can belong to different PLMN. Rapporteur understands this issue is more up to decision by SA2, e.g., impact to the CN architecture if any, and the impact to discovery message content design if any.

**Q3-1: For the issue of “whether the UE-to-Network relay UE and remote UE can belong to different PLMN”, do you think:**

**Case-1: Decision needs to be done in SI (if this option is selected, please indicate whether you support “UE-to-Network relay UE and remote UE belong to different PLMN” in the comment);**

**Case-2: No need to decide at SI phase:**

* **Case-2a: Capture in the TR that this issue is left to WI phase;**
* **Case-2b: No need to capture the issue in the TR;**

|  |  |  |
| --- | --- | --- |
| Company | Which case for this issue(1, 2a, or 2b)? | Comment |
| MediaTek | 2a |  |
| Qualcomm | Case-2b (and wait SA2 conclusion) | We have the same understanding as Rapporteur: it should be concluded in SA2 and then notify RAN2. We don’t think it is an essential issue which needs to be concluded in SI phase in RAN2. Thus, we don’t prefer to capture in TR that “left to WI phase”.Of course, if SA2 agree it, RAN2 can update the TR in future. |
| Lenovo, MotM | 2a | We have a dependency on other groups (SA and CT), so need to wait. |
| Samsung | Case-2b | This issue should be up to SA2 decision. RAN2 can discuss in WI phase if needed. |
| OPPO | 2b | For this issue, since the motivation is still dependent on other WG, we tend to avoid capturing in TR already now. |
| Huawei | 2b | If this is really essential, companies can raise this in WI phase by contribution. |

In [19], one issue raised that since TX power of unicast signal may not be of fixed value due to power control, whether the remote UE has to be aware of the TX power to evaluate the link quality for relay (re)selection.

**Q3-2: For the issue of “whether remote UE needs to know the TX power of unicast link messages”, do you think:**

**Case-2: No need to decide at SI phase:**

* **Case-2a: Capture in the TR that this issue is left to WI phase;**
* **Case-2b: No need to capture the issue in the TR;**

|  |  |  |
| --- | --- | --- |
| Company | Which case for this issue(1, 2a, or 2b)? | Comment |
| MediaTek | 2a |  |
| Qualcomm | Case-2b  | We think it is one kind of enhancement of AS criteria of relay (re)selection, which can be discussed in WI phase in contribution driven manner. At this stage, we don’t see need to capture in TR. |
| Lenovo, MotM | 2b |  |
| Samsung | Case-2b | This can be discussed under relay selection/reselection in WI phase as Q2-3, Q2-4. |
| OPPO | 2b | Share the same view with QC that it can be contribution driven. |
| Huawei | 2b | Companies can always remind us on this consideration in WI phase by contribution. |

In[8], it is proposed to have a relay-specific resource pool for easier QoS enforcement.

Furthermore, rapporteur understands the issue is only for data communication, since the issue for shared/separate resource pool has been addressed separately in discovery section.

**Q3-3: For the issue of “a relay-specific resource pool for communication”, do you think:**

**Case-1: Decision needs to be done in SI (if this option is selected, please indicate whether you support “a relay-specific resource pool for communication” in the comment)**

**Case-2: No need to decide at SI phase:**

* **Case-2a: Capture in the TR that this issue is left to WI phase;**
* **Case-2b: No need to capture the issue in the TR;**

|  |  |  |
| --- | --- | --- |
| Company | Which case for this issue(1, 2a, or 2b)? | Comment |
| MediaTek | 2a |  |
| Qualcomm | Case-2b  | We think it is an optimization. So, it can be discussed in WI phase in contribution driven manner. At this stage, we don’t see need to capture in TR. |
| Lenovo, MotM | 2b |  |
| Samsung | Case-2b | This can be discussed under resource pool design during WI phase. |
| OPPO | 2b | Share the same view with QC that it can be contribution driven. |
| Huawei | 2b | This is really an optimization. |

Besides, there are some discussion on the additional condition(s) for UEs to manage the PC5 link for the relayed connection to network, e.g.,

* For relay UE: In [10], it is proposed relay UE may release the PC5 connection or requesting remote UE to reselect, in case of QoS degradation, or impending handover. In [20], it is proposed that Relay UE may be activated when located in the recommended activation area.
* For remote UE: In [14], remote UE may decide whether to establish/maintain the PC5 connection via UE-to-Network relay according to (pre-)configuration, e.g., when it enters OOC scenario in RRC\_IDLE state, for RAU, paging monitoring or periodic traffic;

On the other hand, rapporteur understand some conditions above are not purely RAN2 related but also of SA2 scope.

**Q3-4: For the issue of “additional condition/trigger(s) for PC5 connection management by UE-to-network Relay UE,** **e.g., QoS degradation, impending handover, activation area”, do you think:**

**Case-1: decision can be done in SI (if this option is selected, please indicate whether you support any of the condition/trigger(s) for “PC5 connection management by UE-to-network Relay UE” in the comment)**

**Case-2: No need to decide at SI phase:**

* **Case-2a: Capture in the TR that this issue is left to WI phase;**
* **Case-2b: No need to capture the issue in the TR;**

|  |  |  |
| --- | --- | --- |
| Company | Which case for this issue(1, 2a, or 2b)? | Comment |
| MediaTek | 2b | The above additional condition/trigger(s) seems in SA2 scope. |
| Qualcomm | Case-2b  | We think it is one kind of enhancement of AS criteria of relay (re)selection, which can be discussed in WI phase in contribution driven manner. At this stage, we don’t see need to capture in TR. |
| Lenovo, MotM | 2b | AS criteria of relay (re)selection can be discussed in WI phase. |
| Samsung | Case-2b | This can be discussed during WI phase. |
| OPPO | 2b | Share the same view with MTK that this includes the dependency with other WG, so maybe good to wait for input from SA2 first before capturing it in TR already now. |
| Huawei | 2b | More clarification are needed before capture something in the TR. |

**Q3-5: For the issue of “additional condition/trigger(s) for PC5 connection management by UE-to-network Remote UE, e.g., entering OOC in RRC\_IDLE, RAU, paging monitoring or periodic traffic”, do you think:**

**Case-1b: decision can be done in SI if this option is selected, please indicate whether you support any of the condition/trigger(s) for “PC5 connection management by UE-to-network Remote UE” in the comment)**

**Case-2: No need to decide at SI phase:**

* **Case-2a: Capture in the TR that this issue is left to WI phase;**
* **Case-2b: No need to capture the issue in the TR;**

|  |  |  |
| --- | --- | --- |
| Company | Which case for this issue(1, 2a, or 2b)? | Comment |
| MediaTek | 2a |  |
| Qualcomm | Case-2b  | We think it is one kind of enhancement of AS criteria of relay (re)selection, which can be discussed in WI phase in contribution driven manner. At this stage, we don’t see need to capture in TR. |
| Lenovo, MotM | 2b | AS criteria of relay (re)selection can be discussed in WI phase. |
| Samsung | Case-2b | This can be discussed during WI phase. |
| OPPO | 2b | Share the same view with MTK that this includes the dependency with other WG, so maybe good to wait for input from SA2 first before capturing it in TR already now. |
| Huawei | 2b | Again, we only need to capture something which is the common view from companies. |

1. xxx.

# Conclusion

We have the following proposals

[Proposal 1 xxx.](#_Toc62216175)

# Reference

1. R2-2100109 Left issues on Scenario and L23 accessment OPPO discussion Rel-17 FS\_NR\_SL\_relay
2. R2-2100123 Finalize the comparison and conclusion section of TR 38.836 Qualcomm Incorporated discussion Rel-17 FS\_NR\_SL\_relay
3. R2-2100171 Discussion on Remote UEs in RRC Inactive MediaTek Inc. discussion Rel-17 FS\_NR\_SL\_relay
4. R2-2100205 Further Clarification on the Sidelink Relay Scenario CATT discussion Rel-17 FS\_NR\_SL\_relay
5. R2-2100309 Comparison of L2 and L3 Relay ZTE Corporation discussion
6. R2-2100444 Remote UE connectivity MediaTek Inc. discussion Rel-17
7. R2-2100523 Relay selection and reselection InterDigital discussion Rel-17 FS\_NR\_SL\_relay
8. R2-2100550 Open Issues on NR Sidelink Relaying Fraunhofer IIS, Fraunhofer HHI discussion
9. R2-2100616 Conclusion on the feasibility of L2 and L3 based Sidelink Relaying Intel Corporation discussion Rel-17 FS\_NR\_SL\_relay
10. R2-2100625 Further details on relay reselection Intel Corporation discussion Rel-17 FS\_NR\_SL\_relay
11. R2-2100980 Comparative analysis of L2 and L3 SL Relay architecture Ericsson, Samsung, Nokia, Nokia Shanghai Bell discussion Rel-17 FS\_NR\_SL\_relay
12. R2-2101180 Consideration on Control Plane messages transmission path for remote UE vivo, Philips, Lenovo, Motorola Mobility, AT&T discussion Rel-17
13. R2-2101210 SI acquisition, CN Registration and RNAU Lenovo, Motorola Mobility discussion FS\_NR\_SL\_relay
14. R2-2101325 Support of idle mode mobility for remote-UE in SL UE-to-Nwk relay Nokia, Nokia Shanghai Bell discussion Rel-17 FS\_NR\_SL\_relay
15. R2-2101453 Providing Reliability and Coverage using Relays Lenovo, Motorola Mobility, Philips, AT&T, Fujitsu discussion FS\_NR\_SL\_relay
16. R2-2101784 Consideration on relay selection and reselection Huawei, HiSilicon discussion Rel-17 FS\_NR\_SL\_relay
17. R2-2101778 Further consideration of relay selection and reselection criteria LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
18. R2-2101785 Relay UE selection and reselection prioritization LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
19. R2-2101788 Relay reselection using discovery message and sidelink unicast link LG Electronics Inc. discussion Rel-17 FS\_NR\_SL\_relay
20. R2-2101890 discussion on RRC procedures of L2 U2N relay ETRI discussion Rel-17 FS\_NR\_SL\_relay
21. R2-2101107 Consideration on U2N relay and U2U relay Lenovo, Motorola Mobility discussion Rel-17