**3GPP TSG RAN WG2 Meeting #114-e R2-2106470  
Electronic Meeting, 19th - 27th May 2021**

**Agenda item: 8.7.3**

**Source: CATT**

**Title: [Pre114-e][603][Relay] Summary on agenda item 8.7.3 on relay (re)selection (CATT)**

**Document for: Discussion and Decision**

# Introduction

This document is to provide a summary of the documents submitted to the AI 8.7.3.

# Discussion

## Sidelink measurements for relay (re)selection

In RAN2#113bis-e meeting, it was agreed that:

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| Proposal 4: RAN2 confirm below NR relay (re)selection procedures which are same as LTE Prose relay:  1) PC5 Measurement: For relay(s) without unicast PC5-S connection, remote UE uses RSRP measurements of sidelink discovery messages (i.e. SD-RSRP) to evaluate whether PC5 link quality of a Relay UE satisfies relay selection and reselection criterion  Proposal 6: In SD-RSRP measurement for relay (re)selection trigger and candidate relay evaluation, L3 filtering is applied across measurements on the DMRS of PSSCH transmission which carries discovery message from the concerned relay. |

The remaining issues on SL measurement for relay (re)selection are as below:

* Which PC5 measurement should be used to trigger relay reselection in case of the remote UE has PC5-S connection with relay UE? Based on only SL-RSRP or based on both SL-RSRP and SD-RSRP?
* In case of no SL data available, how to perform SL-RSRP measurement?
* How to deal with transmit power imbalance issue?

### PC5 measurement selection for triggering relay reselection

In RAN2#113bis-e, the issue which PC5 measurement should be used to trigger relay reselection in case of remote UE has PC5-S connection with relay UE was discussed. The following proposal was made in the related email summary, but no conclusion was reached:

**Proposal 7: RAN2 discuss which alternatives of PC5 measurement to trigger relay reselection. The discussion should consider conclusion of transmit power of discovery message made in discovery session (e.g. whether fixed power or can be configured subject to OLPC).**

* **Alt-1: Based on only SL-RSRP. In case of no data transmission, remote UE can use keep-alive message or triggered PC5-S/CSI reporting from relay UE to perform SL-RSRP based on its implementation.**
* **Alt-2: Based on both SL-RSRP and SD-RSRP. If data is available, only SL-RSRP of data. In case of no data transmission, the remote UE triggers reselection based on SD-RSRP**

[1] [11][20][25] suggested for remote UE is connected with a relay UE, the remote UE uses only SL-RSRP to trigger relay reselection. [3] proposed that relay reselection is triggered based on only SL-RSRP of data if data is available at the remote UE, and if there is no data available for a certain time, the remote UE should then rely on discovery SD-RSRP.[5] proposed for remote UE is connected with a relay UE, remote UE should be based on its implementation to select the measurement approach to evaluate whether PC5 link quality of a relay UE satisfies relay selection and reselection criterion. [4][9][14] proposed remote UE relies on both SL-RSRP and SL-SDRSP to trigger relay reselection.[24] suggested SD-RSRP measurement is prioritized over SL-RSRP. If remote UE can measure SD-RSRP of the discovery message from the current connected relay UE, the remote UE can trigger relay reselection by only using the signal strength of SD-RSRP. Otherwise, the remote UE can trigger relay reselection by using the signal strength of SL-RSRP.

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| Tdoc# | Source | Summary of their proposals |
| R2-2104745 | Qualcomm Incorporated | P5: For relay(s) with unicast PC5 link, the remote UE uses only Rel-16 specified SL-RSRP to trigger relay reselection and candidate relay evaluation. In case of no data transmission, remote UE can use keep-alive message or triggered PC5-S message from relay UE to perform SL-RSRP based on its implementation. |
| R2-2104870 | Interdigital | P1: Relay reselection is triggered based on only SL-RSRP of data if data is available at the remote UE.  P2: If data has not been available at the remote UE for some time, the remote UE triggers reselection based on discovery RSRP. |
| R2-2104889 | Intel Corporation | P4: RAN2 is proposed to agree to Alt-2, i.e. Remote UE relies on both SL-RSRP and SL-SDRSP for PC5 link quality measurement in order to trigger relay reselection. |
| R2-2104893 | OPPO | P1: For relay with unicast PC5 connection, remote UE should be based on its implementation to select the measurement approach to evaluate whether PC5 link quality of a Relay UE satisfies relay selection and reselection criterion. |
| R2-2105492 | Ericsson | P2: For triggering relay reselection, remote UE bases on SL-RSRP of the unicast link between remote UE and relay UE. |
| R2-2105536 | Spreadtrum Communications | P1: The measurement result of sidelink discovery message (SD-RSRP) and sidelink unicast link (SL-RSRP) can be used to trigger relay reselection when below their own thresholds. |
| R2-2106160 | Huawei, HiSilicon | P3: When a Remote UE is connected with a Relay UE, the Remote UE shall use SL-RSRP to evaluate whether PC5 link quality with the Relay UE satisfies relay reselection trigger criterion. |
| R2-2106344 | MTK | P1: RAN2 to adopt purely SL-RSRP measurement for relay reselection. If there is no data transmission, remote UE can use keep-alive message or triggered PC5-S/CSI reporting to perform SL-RSRP measurements. |
| R2-2105515 | Sharp | P1: For relays with unicast PC5 connection, remote UE uses SD-RSRP measurement to evaluate whether PC5 link quality of a relay UE satisfies relay reselection criterion only when there is no data transmission from the relay UE for a while. |
| R2-2105127 | Apple | P5: Support SL-RSRP to be used also for PC5 link quality measurement for relay reselection. Remote UE can calculate the PC5 link pathloss based on its own TX power and received SL-RSRP measurements to neutralize the impact of open-loop power control. |

Although there is divergence, but rapporteur thinks more companies (QC, E///, Huawei, MTK, Interdigital(if there is SL data), OPPO,Apple, Spreadtrum, Sharp(if there is SL data)) support SL-RSRP. Considering this is the last meeting for relay (re-)selection discussion, hence it is suggested to converge this issue. Considering the next issue is related with the current one, we conclude the 2.1.1 and 2.1.2 together.

### SL-RSRP measurement in case of no data transmission

In case of no data transmission, it should further discuss how to perform SL measurement. [1][20][25] suggested to use keep-alive message. [1] [25] also support to trigger PC5-S message. [11][25] suggested to send SCI to peer UE to trigger CSI reporting. [9] proposed that Remote UE triggers model B relay discovery, and performs SL SD-RSRP measurement.

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| Tdoc# | Source | Summary of their proposals |
| R2-2104745 | Qualcomm Incorporated | P5: For relay(s) with unicast PC5 link, the remote UE uses only Rel-16 specified SL-RSRP to trigger relay reselection and candidate relay evaluation. In case of no data transmission, remote UE can use keep-alive message or triggered PC5-S message from relay UE to perform SL-RSRP based on its implementation. |
| R2-2105127 | Apple | P4: Remote UE triggers model B relay discovery when there is no traffic ongoing between remote UE and relay UE to evaluate the pathloss of PC5 link. |
| R2-2105492 | Ericsson | P1: In case of no transmission on a unicast link, in order to measure the SL-RSRP, UE sends a SCI to its peer UE for requesting CSI report. |
| R2-2105515 | SHARP | Proposal 1: For relays with unicast PC5 connection, remote UE uses SD-RSRP measurement to evaluate whether PC5 link quality of a relay UE satisfies relay reselection criterion only when there is no data transmission from the relay UE for a while. |
| R2-2106160 | Huawei, HiSilicon | P2: To reuse the Rel-16 PC5 unicast link keep-alive procedure to address the case of no data traffic on the established PC5 unicast link. |
| R2-2106344 | MTK | P1: RAN2 to adopt purely SL-RSRP measurement for relay reselection. If there is no data transmission, remote UE can use keep-alive message or triggered PC5-S/CSI reporting to perform SL-RSRP measurements. |

According to the above summary, it is hard to make conclusion since only limited companies express their views. On the other hand, the triggering of PC5-S message like keep-alive message, or the triggering of CSI reporting is up to UE implementation in Rel-16. That’s to say, the down-selection is unnecessary and one way to conclude this is to leave this to UE implementation.

**Proposal 1: When a Remote UE is connected with a Relay UE and when there is data transmission, the Remote UE shall use SL-RSRP to evaluate whether the PC5 link quality satisfies relay reselection trigger criterion. It is left to UE implementation to handle the case of no data transmission.**

### Transmit power imbalance issue

No matter SL-RSRP or SD-RSRP will be used for PC5 link quality evaluation, the transmit power imbalance issue should both be considered. [1] proposed to reuse LTE Prose relay scheme, rely on Network / UE implementation to resolve the transmit power imbalance issue on PC5 measurement for relay (re)selection trigger and candidate relay evaluation. [9] suggested Relay UE carry TX power information in SL model A discovery message and SD-RSRP measurement result in SL model B discovery message.

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| Tdoc# | Source | Summary of their proposals |
| R2-2104745 | Qualcomm Incorporated | P4: Same as LTE Prose relay, rely on Network / UE implementation to resolve the transmit power imbalance issue on PC5 measurement for relay (re)selection trigger and candidate relay evaluation |
| R2-2105127 | Apple | P1: Relay UE carry TX power information in its SL discovery message in model A relay discovery. |

As mentioned in [1], as sidelink OLPC should be applied to discovery message, even SD-RSRP may have the same transmit power imbalance issue. Furthermore, LTE Prose relay also has similar power imbalance issue between discovery message and PC5 data transmission. But it was left to Network/UE implementation to resolve it. Hence, the same assumption can be reuse in NR sidelink relay, especially when RAN plenary tasked RAN2 to complete it by June. Therefore, it is proposed RAN2 don’t need to specify solution to resolve transmit power imbalance issue.

Proposal : RAN2 does not pursue further optimization on the transmit power imbalance issue of PC5 measurement for relay (re)selection.

## Triggers of relay selection for L2 U2N relay

It was agreed for L3 U2N relay, remote UE triggers relay selection when a) direct Uu link quality is below a configured threshold for an in-coverage remote UE (in IDLE/INACTIVE and CONNECTED; or b) triggered by upper layer in RAN2#113b-e meeting. L2 case to be further discussed:

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| 2) Trigger of relay selection: Triggered at remote UE when: a) direct Uu link quality is below a configured threshold for an in-coverage remote UE (in IDLE/INACTIVE and CONNECTED for L3 U2N relay; L2 case to be further discussed); or b) triggered by upper layer |

[4] suggested for L2 relay, relay selection trigger at the remote UE directly connected to the gNB, apply same criteria as that agreed for L3 relay, i.e. based on direct Uu link quality below a configured threshold in RRC\_IDLE/RRC\_INACTIVE and RRC\_CONNECTED cases. The configuration can be obtained via SIB/dedicated signalling as in the case of L3 Remote UE. [2] proposed for L2 relay, RRC\_IDLE/RRC\_INACTIVE remote UE apply same criteria as L3 relay. RRC\_CONNECTED remote UE relay selection can be performed by gNB or remote UE itself. RRC\_CONNECTED remote UE relay selection can be triggered based on direct Uu link quality below a configured threshold or gNB implementation.

Considering RAN plenary tasked RAN2 to complete relay (re-)selection by June, hence, it had better rule out the possibility that relay selection is performed by gNB for RRC\_CONNECTED remote UE.

Proposal : For L2 U2N relay, RRC\_IDLE/RRC\_INACTIVE remote UE triggers relay selection when direct Uu link quality is below a configured threshold, and relay selection for RRC\_CONNECTED remote UE by gNB is handled in CP procedure and service continuity topic for L2 relay.

## Additional AS criteria for relay (re)selection

In RAN2#113bis-e meeting, the agreements on AS criteria for relay (re)selection were made:

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| Agreements:  Proposal 2-1 [easy]: For L3 relay, the use of PLMN ID and cell ID in relay (re)selection is up to SA2  Proposal 2-2 [easy]: For L2 relay, PLMN ID supported as additional AS criteria for relay (re)selection. Whether cell ID is used can be further discussed by RAN2.  Proposal 3-1 [easy]: Besides serving cell ID, PLMN ID, L2/L3 relay support (if agreed in discovery session) and relay load, other additional AS criteria are not considered in this release. |

According to the above agreements, the following remaining issues with AS criteria of relay (re)selection need to be further discussed:

* Whether cell ID is used as additional AS criteria?
* Whether relay UE load is used as additional AS criteria? Further, how to define Relay UE load if it is agreed as AS criteria?
* How to indicate L2/L3 relay support (if agreed in discovery session)?

### Cell ID

It has agreed for L3 relay, the use of cell ID in relay (re)selection is up to SA2. Therefore, this issue is only for L2 relay.

[2][4] [6] [8][11][13][15][22][23] suggested to use cell ID as AS criteria for relay (re)selection to prioritize the candidate relay UE which is served by the same gNB. [20] mentioned that it is unnecessary to check cell ID during relay (re)selection by the remote UE in RRC\_IDLE/INACTIVE state. And the cell ID should be considered as the work scope of service continuity is limited to intra-gNB cases. Remote UE may report cell ID to assist the network to control the remote to switch to a relay within the same gNB. However, cell ID is not taken as an AS criterion. [1] suggested to discuss whether to include cell ID as additional AS criteria in L2 relay control plane AI. [14] did not support cell ID as additional AS criteria for relay (re)selection.

Considering the mobility is restricted to intra-gNB mobility according to the WID, hence when a remote UE is moving away from the serving cell, a relay in the coverage of the serving gNB would be a better choice than a relay in the coverage of the new gNB. However, similar to Proposal 4 above, since the relay (re)selection for CONNCTED L2 remote UE is to be addressed by CP procedure (e.g., for RRC Re-establishment procedure) and service continuity, it is suggested to leave the detailed design to CP procedure and service continuity topic.

Proposal 5: For L2 U2N relay, cell ID can be used as additional AS criteria for relay (re)selection. RRC states under which the cell ID may be applied by L2 remote UE and how to use it by L2 remote UE are left to be addressed for L2 specific discussions. And the usage of cell ID by gNB for RRC CONNECTED L2 remote UE is handled by CP procedure and service continuity topic for L2 relay.

Furthermore, [6] discussed two kinds of cell ID:

1. NR Cell Identity (NCI): used to unambiguously identify a cell within a PLMN. **36bits.**
2. Physical cell identity (PCI): used to distinguish cells on the radio side, related to DL synchronization. In NR it is **10 bits** (INTEGER (0..1007)).

And NCI is suggested. Considering it is too detailed, it can be left to stage-3 discussion.

### Relay UE load

In [12], definition of relay load criterion was discussed. But no consensus on relay load.

[1] proposed relay UE load is not pursued as AS criteria of relay (re)selection. [10] suggested not to specify "load" as a relay selection or reselection criteria in Rel-17. [3][8][11][19] suggested to consider relay UE load as AS criteria of relay (re)selection. And companies’ views on the definition of relay load in contributions are summarized below:

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| Tdoc# | Source | Summary of their proposals |
| R2-2104745 | Qualcomm Incorporated | P1: RAN2 discuss whether Resource Status Indicator (RSI) defined in LTE discovery can be specified as additional AS criteria for relay (re)selection. Other options on relay UE load is not pursued in this release |
| R2-2104847 | Interdigital | P4: A CR-like metric is used to define relay load |
| R2-2104959 | vivo | P1: Remote UE can know the relay load to perform relay (re)selection, but how to evaluate relay load by relay UE is not specified and left to relay UE implementation.  P2: RAN2 to decide the content of indication (e.g. high/medium/low load level) of Relay Load at relay UE if it is supported as relay (re-)selection criterion. |
| R2-2104971 | Fraunhofer | P3: The measured CBR at a relay can be considered as resource pool usage which reflects the load in a relay UE. |
| R2-2104977 | ZTE | P2: It is suggested to consider relay load as AS criteria for relay (re)selection. The “resource pool usage or capacity" cans be considered as the metrics for the relay UE load. |
| R2-2105127 | Apple | P6: Follow LTE legacy, Support “Relay load status” as an additional criteria for relay (re)selection  P7: RAN2 discuss the two options for Relay UE set the relay load status: 1) there can be two options: 1) map the number of remote UEs or the number of PC5-RRC connection to a load value based on defined formula; or 2) or left for UE implementation. |
| R2-2105492 | Ericsson | P5: Adopt Option 4, i.e., free bandwidth (or achievable bit rate) that relay UE can provide for relay traffic as the relay load definition. |
| R2-2105695 | Sony | P2: Number of remote UEs being served by relay UE or high load/low load indication should be considered in NR sidelink relay re-selection. |
| R2-2105750 | Xiaomi | P5: It is proposed that the Remote UE behaviour on reception of a simple load indication for this release be left to UE implementation. |
| R2-2106011 | Continental Automotive | P1: Consider a composite load metric that captures both the PC5 as well as the Uu load conditions. |
| R2-2106203 | MTK | P2: Define Relay UE load as number of UEs being served by the relay UE |
| R2-2106251 | CMCC | P2: Down selection from option1 and option3 as criteria for relay selection.  Option 1: Number of PC5 connections to Remote UEs currently being actively used for relaying  Option 3: Number of remote UEs being served by the relay UE |
| R2-2106268 | LG | P4: The ‘status indicator’ in the discovery message in LTE can be used to show the load of relay UE. |

Although some companies supports to consider relay load when performing relay (re-)selection, but there are divergence on how to define the relay load, listed below:

* **Option 1: Number of PC5 connections to Remote UEs currently being actively used for relaying;**
* **Option 2: Resource pool usage or capacity;**
* **Option 3: Number of remote UEs being served by the relay UE;**
* **Option 4: free bandwidth (or achievable bit rate) that relay UE can provide for relay traffic;**
* **Option 5: Leave to UE implementation;**
* **Option 6: Network indication, gNB provides the load indication, e.g. high or low. Relay UE follows gNB’s indication;**
* **Option 7: Resource Status Indicator (RSI) defined in LTE discovery;**
* **Option 8: CR-like metric.**

Considering there is another ongoing discussion for this topic, in order to not to introduce further confusion. No proposal is needed for the current section.

### L2/L3 relay support

[8] indicated that according to SA2’s progress, the relay service code included in discovery message can indicate if the UE-to-Network Relay is a Layer-3 or Layer-2 UE-to-Network Relay. [1] suggestd up to SA2 to decide whether to include L2/L3 relay support in discovery message.

[6] observed SA2 has agreed that UE may indicate the 5G ProSe capability which may indicate whether the UE is capable of one or more of the following 5G ProSe capabilities: ProSe Direct Discovery, ProSe Direct Communication, Layer-2 and/or Layer-3 ProSe UE-to-Network Relay and Layer-2 and/or Layer-3 Remote UE. Hence, it proposes that capability of L2/L3 relay can be used as additional AS criteria for relay (re)selection.

Proposal : RAN2 further discussesthat whether L2/L3 relay support is used as additional AS criteria for relay (re-)selection.

Proposal : It is up to SA2 to decide how to include L2/L3 relay support in discovery message.

## Coupling with cell (re)selection

In RAN2#113b-e, the following agreements were made:

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| Agreement:  Proposal 8: If both a suitable cell and a suitable relay are available, the remote UE can select either one (or both, for L3 relay only) based on its implementation in this release (i.e. TS 38.304 will not specify any additional procedure for selecting between the cell and the relay). FFS whether any enhancements to the cell (re)selection procedure for L2 relay. |

FFS whether any enhancements to the cell (re)selection procedure for L2 relay. And companies’ views in contributions are summarized below:

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| Tdoc# | Source | Summary of their proposals |
| R2-2104745 | Qualcomm Incorporated | P12: Same as LTE Prose relay, no procedure needs to be specified for the coupling between relay (re)selection and cell (re)selection for L3 relay |
| R2-2104747 | CATT | P9: For RRC\_CONNECTED remote UE, the priority of intra-gNB cell or U2N relay for L2 U2N relay (re)selection is higher than inter-gNB cell or U2N relay.  P10: For IDLE/INACTIVE remote UE, the priority of intra-gNB cell or U2N relay for L2 U2N relay (re)selection is same as inter-gNB cell or U2N relay. |
| R2-2104870 | Interdigital | P7: The remote UE can be configured to prioritize either cell (re)selection or relay (re)selection in some cases (e.g., upon the trigger of re-establishment). |
| R2-2104893 | OPPO | P2: RAN2 does not need to pursue any specification impact on capturing the stop condition for neither transmitting/monitoring discovery message, nor relay selection/reselection. |
| R2-2104959 | vivo | P7: For L2 relay, RAN2 to discuss if we need to limit the case to happen that both a suitable cell and a suitable relay are available (e.g. make the UE (re)start/stop cell (re)selection evaluation based on relay UE indication after connected to relay UE).  P8: If Proposal 7 is not agreed and the case happens that both a suitable cell and a suitable relay are available to be (re)selected, RAN2 to study enhancements on remote UE behaviour e.g.:  - Remote UE will select a relay UE or a cell based on pre-defined rules (e.g. prioritize one of them);  - Remote UE will select a relay UE or a cell based on network configuration/indication;  P9: For L2 relay, if both a suitable cell and a suitable relay are available and the UE (re)selects a relay UE (or a cell), the UE should not reselect to another cell (or another relay UE) before some time has elapsed (e.g. 1 second). |
| R2-2104977 | ZTE | P10: Suppose the relay re-selection of RRC\_Connected remote UE is triggered by Uu RLF with gNB, or PC5 RLF with relay UE, or relay UE’s Uu RLF, the remote UE is suggested to prioritize the re-selection of a relay which is served by the same cell/gNB.  P11: Suppose the cell re-selection of RRC\_Connected remote UE is triggered by PC5 RLF or relay UE’s Uu RLF, the remote UE is suggested to prioritize the re-selection of cell which is the relay UE’s serving cell or gNB. |
| R2-2105492 | Ericsson | P8: During relay (re)selection procedure, remote UE bases the existing cell (re)selection procedure to search suitable cells, no further enhancements are needed for the cell (re)selection procedure in this release. |
| R2-2106160 | Huawei | P4: Before connecting to a Relay UE, Remote UE can perform cell selection/reselection and relay selection independently.  P5: After the Remote UE connects to a Relay UE, it performs Relay UE reselection but not required to perform cell selection unless no suitable Relay UE is found.  P6: The legacy cell (re)selection procedure and relay (re)selection procedure could go independently and no more combined procedure is needed. |
| R2-2105536 | Spreadtrum Communications | P2: For L2 relay, if both a suitable cell and a suitable relay are available, the Remote UE can select either one based on its implementation. |

Still, there are proposals on the special handling for RRC\_CONNECTED L2 remote UE, which is of the scope of service continuity and CP procedure (i.e., RRC re-establishment) procedure. While for RRC\_IDLE/INACIVE state, the majority view seems to rely on UE implementation.

Proposal : For RRC\_IDLE/INACTIVE L2 remote UE, the legacy cell (re)selection procedure and relay (re)selection procedure could go independently and up to UE implementation to select either cell or relay. For RRC\_CONNECTED L2 remote UE, it is handled by CP procedure and service continuity topic for L2 relay.

## UE actions in case of relay selection and reselection

[11] discussed the UE behaviours of relay selection and reselection. Proposals are below:

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| Tdoc# | Source | Summary of their proposals |
| R2-2105492 | Ericsson | P9: Upon reception of discovery messages, remote UE can build a list of relay UE candidates sorted in terms of one or multiple conditions, remote UE selects the first relay UE candidate in the list to set up the link.  P10: Define a validity timer for remote UE to determine for how long time a stored relay UE candidate is valid.  P11: Remote UE selects the next relay UE candidate in the list if the connection establishment fails towards the first relay UE candidate.  P12: In case of relay UE reselection, remote UE may trigger a path switch towards another relay UE which is in the list without performing a discovery procedure first.  P13: In case of relay UE reselection, remote UE may select either a target Uu link or a target relay UE to re-establish the link according to radio signal strength. |

From rapporteur perspective, considering the limited time, the detail of UE behaviour (i.e., the maintenance of relay UE list), of relay selection and reselection can be handled as in LTE, i.e., up to UE implementation. So no proposal is needed for this section.

## PC5/Uu RLF handling

In RAN2#113b-e, RLF triggered relay (re)selection was discussed, and the following agreements were made with 3 FFSs:

Proposal 8: RAN2 confirm that remote UE triggers relay reselection if PC5 RLF with current relay UE is detected by remote UE. FFS if there is any impact to other RLF handling activities.

Proposal 6: When PC5 RLF is detected by relay UE on a PC5 unicast link towards a remote UE, relay UE in RRC\_CONNECTED sends the PC5 RLF indication to gNB (as supported in R16 specification).

Proposal 4: When Uu RLF is detected by relay UE, relay UE may send a PC5-S message (similar to LTE) to its connected remote UE(s) and this message may trigger relay reselection. FFS other indication/message can also be used for notification.

Proposal 5: When relay performs HO to another gNB, relay UE may send a PC5-S message (similar to LTE) to its connected remote UE(s) and this message may trigger relay reselection. FFS other indication/message can also be used for notification.

[1] mentioned that in this section, it had better to address the 3 FFSs only for L3 relay because the discussion on L2 relay can’t avoid the overlapping with RRC re-establishment procedure. According to the rapporteur’s understanding, the RLF handling is not related to relay (re-)selection procedure itself and it is more related to the control plane, hence it does not need to make conclusion here. It can be further discussed in the control plane procedure session.

[1] suggested RAN2 to confirm that the agreed is the Disconnect Request message. [1] also proposed for L2 relay, other indication/message can also be used for Uu RLF or inter-gNB HO notification can be discussed in L2 relay control plane AI. [2][3][4] suggest PC5-RRC message can be used to send Uu RLF or inter-gNB HO indication to the remote UE. [4] wanted to send a LS to SA2 to ask if it is feasible to introduce PC5-S message to trigger Relay reselection upon Uu RLF/HO indication from AS layer at Relay UE. From rapporteur perspective, which PC5-S message is used to carry “PC5-S message (similar to LTE) to notify remote UE Uu RLF and HO” and whether PC5-RRC message can be used can be discussed after RAN2#92-e.

[2][8][10][18] consider when relay UE Uu RLF recovery success, relay UE may send Uu RLF recovered indication to the remote UE, the remote UE may continue the sidelink relay operation with the relay UE. Further, [8][18] propose relay UE sends Uu recovery failed indication to the remote UE. [8] proposes also relay UE sends Uu recovery at new gNB indication to the remote UE. [1][10] suggest to include the cause value in Uu RLF and inter-gNB HO notification message. From rapporteur perspective, this part can be discussed after RAN2#92-e.

For the issue that whether / when does remote UE trigger relay (re)selection upon reception of notification of Uu RLF or inter-gNB HO? [1] proposed that up to remote UE implementation. [8] proposed that RRC\_CONNECTED remote UE can trigger the relay (re)selection. RRC\_IDLE/INACTIVE remote UEs may keep the PC5 connection with relay UE and receive the paging forwarding from relay UE. [18] proposed that remote UE should perform relay reselection once the remote UE receives the recovery failure or handover failure notification from the L2/L3 relay UE. [4] considered that for L2 relay, remote UE will perform relay reselection upon both Uu RLF and inter-gNB HO indications. For L3 relay, remote UE will perform relay reselection upon only Uu RLF. According to the rapporteur’s understanding, for RRC\_CONNECTED remote UE via relay, if Uu RLF happens, the handling is related to path switch, which should also be discussed in the section of service continuity session. For RRC\_IDLE and RRC\_INACTIVE UE, if the relay connection is kept while the Uu link is RLF, there is no much problem. Hence considering the timeline for relay (re-)selection discussion, it had better not introduce any enhancement for RRC\_IDLE and RRC\_INACTIVE UE. Based on the above analysis, no proposal is needed for this part.

[18] suggested the remote UE can response the received Uu RLF/inter-gNB HO indication to inform the relay UE with ‘keep/release PC5 connection’.

[10] suggested the Relay UE may send an early Uu RLF notification message to the Remote UE before the Uu RLF occurs to minimize service interruption time duration. From rapporteur perspective, it is enhancement, rapporteur suggests RAN2 to de-prioritize it in Rel-17.

[7] suggested to change the agreement to “When relay performs HO to another gNB, relay UE shall send a PC5-S message (similar to LTE) to its connected remote UE(s) and this message may trigger relay reselection. FFS other indication/message can also be used for notification.” From rapporteur perspective, the change is not needed since only RRC\_CONNECTED remote UE needs to trigger relay reselection upon receipt inter-gNB HO indication. Relay UE may not send inter-gNB HO indication to RRC\_IDLE/INACTIVE remote UE.

Considering we really need to converge for RAN2#114-e, no proposal is raised for this session.

# Conclusion

*Sidelink measurements for relay (re)selection*

**Proposal 1: When a Remote UE is connected with a Relay UE and when there is data transmission, the Remote UE shall use SL-RSRP to evaluate whether the PC5 link quality satisfies relay reselection trigger criterion. It is left to UE implementation to handle the case of no data transmission.**

Proposal 3: RAN2 does not pursue further optimization on the transmit power imbalance issue of PC5 measurement for relay (re)selection.

*Triggers of relay selection for L2 U2N relay*

Proposal 4: For L2 U2N relay, RRC\_IDLE/RRC\_INACTIVE remote UE triggers relay selection when direct Uu link quality is below a configured threshold, and relay selection for RRC\_CONNECTED remote UE by gNB is handled in CP procedure and service continuity topic for L2 relay.

*Additional AS criteria for relay (re)selection*

Proposal 5: For L2 U2N relay, cell ID can be used as additional AS criteria for relay (re)selection. RRC states under which the cell ID may be applied by L2 remote UE and how to use it by L2 remote UE are left to be addressed for L2 specific discussions. And the usage of cell ID by gNB for RRC CONNECTED L2 remote UE is handled by CP procedure and service continuity topic for L2 relay.

Proposal 6: RAN2 further discussesthat whether L2/L3 relay support is used as additional AS criteria for relay (re-)selection.

Proposal 7: It is up to SA2 to decide how to include L2/L3 relay support in discovery message.

*Coupling with cell (re)selection*

Proposal 8: For RRC\_IDLE/INACTIVE L2 remote UE, the legacy cell (re)selection procedure and relay (re)selection procedure could go independently and up to UE implementation to select either cell or relay. For RRC\_CONNECTED L2 remote UE, it is handled by CP procedure and service continuity topic for L2 relay.

# For Session chair (discussion plan)

**Proposals which may be agreed without online discussion**

**Proposal 1: When a Remote UE is connected with a Relay UE and when there is data transmission, the Remote UE shall use SL-RSRP to evaluate whether the PC5 link quality satisfies relay reselection trigger criterion. It is left to UE implementation to handle the case of no data transmission.**

Proposal 4: For L2 U2N relay, RRC\_IDLE/RRC\_INACTIVE remote UE triggers relay selection when direct Uu link quality is below a configured threshold, and relay selection for RRC\_CONNECTED remote UE by gNB is handled in CP procedure and service continuity topic for L2 relay.

Proposal 5: For L2 U2N relay, cell ID can be used as additional AS criteria for relay (re)selection. RRC states under which the cell ID may be applied by L2 remote UE and how to use it by L2 remote UE are left to be addressed for L2 specific discussions. And the usage of cell ID by gNB for RRC CONNECTED L2 remote UE is handled by CP procedure and service continuity topic for L2 relay.

Proposal 7: It is up to SA2 to decide how to include L2/L3 relay support in discovery message.

Proposal 8: For RRC\_IDLE/INACTIVE L2 remote UE, the legacy cell (re)selection procedure and relay (re)selection procedure could go independently and up to UE implementation to select either cell or relay. For RRC\_CONNECTED L2 remote UE, it is handled by CP procedure and service continuity topic for L2 relay.

**Proposals online discussion**

Proposal 3: RAN2 does not pursue further optimization on the transmit power imbalance issue of PC5 measurement for relay (re)selection.

Proposal 6: RAN2 further discussesthat whether L2/L3 relay support is used as additional AS criteria for relay (re-)selection.

# References

1. R2-2104745 Remaining issues on relay (re)selection Qualcomm Incorporated
2. R2-2104747 Remain Issues on Relay (Re)selection CATT
3. R2-2104870 Relay selection and reselection InterDigital
4. R2-2104889 Open aspects of Relay (re)selection Intel Corporation
5. R2-2104893 Discussion on remaining issues of NR sidelink relay (re)selection OPPO
6. R2-2104959 Remaining issues on Relay (re)selection vivo
7. R2-2104971 Remaining Open Issues on Relay (re-)selection Fraunhofer HHI, Fraunhofer IIS
8. R2-2104977 Discussion on Relay selection in Sidelink Relay ZTE, Sanechips
9. R2-2105127 Discussion on remaining issues of relay (re)selection and discovery Apple
10. R2-2105238 Discussion on some relay (re)selection issues Nokia, Nokia Shanghai Bell
11. R2-2105492 Aspects for SL relay selection and reselection Ericsson
12. R2-2105496 [Post113bis-e][602][Relay] Definition of relay load criterion Ericsson
13. R2-2105515 Discussion on sidelink relay reselection SHARP Corporation
14. R2-2105536 Discussion on Ralay selection and reselection Spreadtrum Communications
15. R2-2105695 Relay (re)selection Sony
16. R2-2105750 Remote UE use of Relay UE Load Indication Beijing Xiaomi Mobile Software
17. R2-2105790 Remaining PDB in UE-to-NW and UE-to-UE Relay Nokia, Nokia Shanghai Bell
18. R2-2105808 Relay (re)selection for L2 and L3 relay Lenovo, Motorola Mobility
19. R2-2106011 View on definition of relay load criterion Continental Automotive GmbH
20. R2-2106160 Remaining issues on relay selection and reselection Huawei, HiSilicon
21. R2-2106203 Use of relay load as a Relay (re)selection criterion MediaTek Inc.
22. R2-2106251 Remaining issues on AS criteria for relay selection CMCC
23. R2-2106268 AS layer criteria for relay selection and reselection LG Electronics Inc.
24. R2-2106271 left L2/L3 common issues for relay selection and reselection LG Electronics Inc.
25. R2-2106344 Other remaining issues on (re)selection MediaTek Inc.