**3GPP TSG-RAN WG2 Meeting #117 electronic R2-220xxxx**

**Online, February, 2022**

**Agenda item: 8.7.2.2**

**Source: OPPO**

**Title: Summary of [621]**

**Document for: Discussion and Decision**

# Introduction

This document is for the following discussion

* [AT117-e][621][Relay] Additional issues on service continuity (OPPO)

      Scope: Filter the issues raised in company tdocs under agenda item 8.7.2.2, determine if any critical issues need resolution, and attempt to converge on any critical issues.

      Intended outcome: Report to Friday online session

      Deadline:  Thursday 2022-02-24 1200 UTC

# Discussion

## 2.1 Additional Issue

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| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 9: Extend the PC5 RRC notification message to include the cause value that relay fails to enter CONNECTED. | Moderator understand it is related to the P8 of [Pre117-e][603].  Proposal 8: When the new T304-like timer is stopped in remote UE but the direct to indirect path switch fails due to IDLE/INACTIVE relay UE fails to establish the connection on Uu hop of indirect path, a similar handling as relay UE’s HO/Uu RLF, i.e.:  -Upon relay UE receives RRCReject or experiences other connection establishment/resume failure, it either triggers PC5-S release or sends notification message indicating Uu RRC connection failure to remote UE.  -PC5-S release or notification message shall trigger remote UE’s RRC reestablishment. But in case of notification, remote UE can choose to keep the current PC5 connection with this target relay, or release the PC5 connection and reselect to other relay.  Yet P8 did not mention the cause value introduction so can be asked here. |

**Q1: For the case where RRC\_IDLE/RRC\_INACTIVE Relay UE fails to enter RRC\_CONNECTED state, do you agree to introduce a cause value into the PC5-RRC notification message?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Qualcomm | Yes | Proponent  The failure to enter CONNECTED state may be due to non-radio reason (e.g., failure to be authorized to act as a L2 Relay in current TA or after TAU), which is different from existing cause (i.e., Uu-RLF/HO/Cell-reselection). And please note it is not restricted to only direct-to-indirect path switch when relay UE is IDLE/INACTIVE state (i.e., it can a general scenario when relay UE failed in TAU). Thus, we think it is reasonable to extend existing PC5 RRC message for notification. |
| ASUSTeK | Yes with comment. | Yes if it is agreed for relay UE to send the notification message in discussion on P8 of [Pre117-e][603]. Otherwise (i.e. triggering PC5-S release is agreed), no new cause value needs to be introduced. |
| Xiaomi |  | We understand this issue has been covered by Pre meeting discussion. We don’t need duplicated discussion. |
| Ericsson | Yes | It can be useful for the Remote UE to identify that the path switch has failed. |
| Sharp | Yes | It is benefit for remote UE connection recovery. |
| vivo | No with comment | Instead, we think all those exceptional cases discussed till now can be incorporated into two values: *Uu link problem* and *Relay Mob*, where the later includes Relay HO and cell reselection cases and the former encompassing all the cases where Relay’s Uu link is down, e.g. Uu RLF, RRC Reject, resume failure, etc. |
| CATT | No with comment | We share the same view as vivo. As we had the similar discussion in relay (re)selection topic, there is minority to support additional cause value into the PC5-RRC notification message. Let’s make life easier. |
| Samsung | Yes | Agree with Qualcomm |
| Huawei, HiSilicon | Yes with comment | This is related to the P8 of [Pre117-e][603]. Maybe we can discuss P8 first. |
| Kyocera | Yes | We think it’s useful for the relay UE to send the notification message, preferably with the cause “RRC Reject” to allow the remote UE to have the same UE behaviour as in the direct path. |
| Apple | Yes | When an existing PC5-RRC message can be reused to help solve a problem, it is better to support tis with some small changes/enhancements. In general, we support to maximize the benefits of existing PC5-RRC protocols. |
| Intel | Yes |  |
| Lenovo | Yes | It is helpful for remote UE to differentiate from RLF or HO. |
| ZTE | No with comment | We share the same view with vivo and CATT that one failure indication covers all relay’s Uu link problems is enough. |
| InterDigital | Yes | Agree with QC |
| Fujitsu | Yes | It can inform the remote UE of the connection failure of the relay UE and make the remote UE perform the corresponding actions. |

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| [**R2-2202848**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202848.zip) | ASUSTeK | Proposal 1: RAN2 to discuss and decide whether a L2 U2N remote UE can establish multiple unicast links with a L2 U2N relay UE for relaying traffic. | The discussion of whether to support multiple unicast links between a U2N remote UE and relay UE was touched in post-116 discussion, which should be addressed. |
| [**R2-2202341**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202341.zip) | OPPO | Proposal 1: RAN2 not pursue optimization on per-PDU-session RSC in service-continuity. | Related to P1 of R2-2202848, which can be jointly discussed. |
| [**R2-2202848**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202848.zip) | ASUSTeK | Proposal 2: If RAN2 only support single unicast link between the L2 U2N remote UE and the L2 U2N relay UE for relaying traffic, it is suggested that RAN2 sends an LS to inform SA2 about this restriction. Otherwise (i.e. multiple unicast links between the L2 U2N remote UE and the L2 U2N relay UE for relaying traffic are supported), gNB needs to include multiple PC5 configurations (each PC5 configuration is for one unicast link and is associated with one PDU session) in the RRCReconfiguration message sent to the remote UE and the target relay UE for initiating direct to indirect path switching. | Related to P1 of R2-2202848, which can be jointly discussed. |
| [**R2-2202848**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202848.zip) | ASUSTeK | Proposal 3: Extra PDU sessions not supported by the target L2 U2N Relay UE should be released during direct to indirect path switching. | Related to P1 of R2-2202848, which can be jointly discussed. |
| [**R2-2202848**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202848.zip) | ASUSTeK | Proposal 4: A L2 U2N Remote UE includes PDU session ID(s) supported by each candidate L2 U2N relay UE in the measurement report. | Related to P1 of R2-2202848, which can be jointly discussed. |

**Q2-1: Do you agree the RSC definition for L2 Relay is out of RAN2 scope and thus can be left to SA2 decision?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes | Technically, we hold different view as ASUSTek, i.e., there is no mapping between RSC vs. PDU session for L2 relay. Nevertheless, this is a SA2 issue and thus we do not see the need to dig into it from R2 perspective. Interested companies can go to S2 to raise the proposal (we observed some attempt in this direction already). |
| Qualcomm | Yes | Same view as OPPO. We don’t prefer involve SA2 at this late stage. |
| ASUSTeK | See comment | According to clause 6.3.2.3.1 and clause 6.4.3.6 in TS 23.304, RSC is included in discovery message and Direct Communication Request message to identify a connectivity service.  Besides, clause 6.4.3.6 in TS 23.304 further specifies “A 5G ProSe Remote UE and a 5G ProSe UE-to-Network Relay shall set up a separate PC5 unicast links if an existing unicast link(s) was established with a different Relay Service Code …”.  It seems to us that one RSC corresponds to one connectivity service (i.e. one PDU session). If this is a correct understanding, the related issues raised in R2-2202848 should be addressed to make sure service continuity can work properly. Since the RSC definition may cause impact on RAN2, we suggest to send an LS to ask SA2 whether one RSC corresponds to one PDU session if people have concern on the RSC definition. |
| Xiaomi | Yes |  |
| Ericsson | Yes |  |
| Sharp | Yes |  |
| CATT | Yes |  |
| Samsung | Yes | Agree with OPPO |
| Huawei, HiSilicon | Yes |  |
| Kyocera | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| InterDigital | Yes |  |
| Fujitsu | Yes |  |

**Q2-2: Do you agree that in Rel-17, RAN2 focus on the scenario where remote UE and relay UE establish a single unicast link (instead of multiple uncast links)?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes | Based on the current design (reflected in the running-CR), remote UE and relay UE would be configured for a single sidelink in-between. Therefore, there seems no particular motivation and mechanism to enable multiple unicast links between one remote and relay UE from R2 perspective. |
| Qualcomm | Yes | Per previous agreement in RAN2#111-e:  Revised Proposal 12: For UE to UE relay, RAN2 assumes the remote UE has an active end to end connection via only a single relay UE at a given time. |
| ASUSTeK | See comment | If one RSC corresponds to one PDU session and it is agreed to support one single unicast link, extra PDU sessions needs to be released during direct to indirect path switching. If we want to keep more than one PDU session, multiple unicast links needs to be supported. |
| Xiaomi | Comments | We understand multiple sidelink unicast connections are not supported for a given pair of destination and source L2 ID pair. Therefore, different source and destination ID pairs would be used if there are multiple unicast links between relay and remote UE. With this understanding, current design can cover this case to switch the path individually.  [Rapp] we do not think this is supported since in this way, multiple IDs have to be allocated to the same remote UE via Uu, and different PC5 RLC channel configuration have to be configured, and a left issue on how to split the Uu connection between the multiple sidelink connection.. do we really have a valid scenario to justify the effort for all these additional work?  [ASUSTeK] Rapp seems to consider there is no issue for the scenario where there are multiple PDU sessions active in the remote UE when direct to indirect path switching occurs, which implies **one single PC5 unicast link established between L2 U2N remote UE and L2 U2N relay UE can support traffic relaying for multiple PDU sessions**. If this is the case, it is better to for RAN2 to confirm this working assumption since this concept has not been addressed in previous discussions so as to avoid people revisiting this issue again in the future. |
| Ericsson | Yes |  |
| Sharp | Yes |  |
| vivo | Comments | The question seems not clear enough: is it trying to exclude multiple unicast links for relay between a pair of UE, or exclude that a pair of UEs cannot have both a relay link and a non-relay link(s) (e.g. V2X unicast link)?  We are OK to exclude the former but don’t think it necessary to exclude the later.  [Rapp] confirm it is to exclude the former one |
| CATT | Yes |  |
| Samsung | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Kyocera | Yes |  |
| Apple | See comment | Is there a particular reason to rule out multiple link case? If relay UE and remote UE has multiple links between them, it will appear just like two independent links. The split of Uu link is up to gNB implementation, we do not see a big problem to support this. Anyway, one relay UE can support multiple remote UEs, which split is already supported. |
| Intel | No |  |
| Lenovo | Yes with comments | One remote UE and relay UE establishes a single unicast link for relay purpose. |
| ZTE | Yes |  |
| InterDigital | Yes |  |
| Fujitsu | Yes |  |

**Q2-3: Do you agree to send LS to SA2 to inform RAN2 on the conclusion of Q2-2, if it concludes as a single unicast link is supported by RAN2 in Rel-17?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| ASUSTeK | Yes | We think it is better to send an LS to inform SA2 about this restriction to avoid wrong expectation from RAN2 which may result in misaligned designs in SA2 and RAN2. |
| vivo | No | RAN2 can make this decision. |
| CATT | No | Same view as vivo. |
| Huawei, HiSilicon | No |  |
| Kyocera | Yes | We agree with ASUSTeK that an LS~~2~~ should be sent to SA2. |
| Apple | See comment | SA2 spec does not rule out multiple RSC and multiple PC5 links. RAN2 should be able to support it too. |
| ZTE | No |  |
| InterDigital | Yes |  |

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| [**R2-2202821**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202821.zip) | Huawei, HiSilicon | Proposal: The selection of the NCGI (i.e. PLMN ID+Cell Identity) from cellAccessRelateInfo to be included in MR can be left to remote UE implementation. | Need to discuss |

**Q3: What option do you prefer for NCGI reporting in case of RAN-sharing scenario?**

**Option 1: The first PLMN ID associated NCGI**

**Option 2: remote UE’s selected PLMN associated NCGI**

**Option 3: all NCGIs in relay UE’s discovery message**

**Option 4: Up to remote UE implementation to choose one NGCI in *cellAccessRelatedInfo***

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| --- | --- | --- |
| Company | Option | Comment |
| Qualcomm | Option 2 (can also accept option 3) | In existing Uu RRC, it is Option 3:  3> if the cell indicated by *cellForWhichToReportCGI* is an NR cell:  4> if *plmn-IdentityInfoList* of the *cgi-Info* for the concerned cell has been obtained:  5> include the *plmn-IdentityInfoList* including *plmn-IdentityList*, *trackingAreaCode* (if available), *ranac* (if available), *cellIdentity* and *cellReservedForOperatorUse* for each entry of the *plmn-IdentityInfoList*;  However, the intention of NCGI reporting in Uu is for ANR purpose. While in L2 relay, the intention is just to provide serving cell ID of relay UE included in measurement report. And we don’t think ANR can be supported in this release for L2 relay. Based on this consideration, we think Option 2 is best. However, we can also accept Option 3 for forward compatibility consideration. |
| Xiaomi | Option 3 |  |
| Ericsson | Option 2 | We agree with QC’s comment. |
| Sharp | Option 3 |  |
| vivo | Option 4 | Since NCGI of different gNB won’t overlap, no matter which NCGI of the relay-forwarded cellAccessRelatedInfo is reported, the serving gNB can tell whether the relevant relay is under its coverage or not.  For Option 2, we wonder what if the cellAccessRelatedInfo included in Relay’s discovery msg does not include the selected PLMN associated NCGI of the remote UE. So, if Option 2 is to be adopted, should it be the NCGI of relay’s serving cell that is reported alternatively? In our understanding, a relay UE whose PLMN is different from remote UE's currently selected PLMN can be a candidate relay, as long as such relay UE's serving PLMN is one of the remote UE's authorized PLMN list. |
| CATT | See comments | Indeed every option can work. But considering this is the last meeting we have, we have a slightly preferred option4 which has no spec impacts.  By the way, during this week, SA2 will discuss that whether to include the NCGI of the serving cell of the L2 Relay in discovery message. With this prerequisite, if SA2 concluded this issue, we think there is no need to further discuss the current question any more(That’s to say, we can directly use the relay UE’s NCGI in the discovery message into the MR). |
| OPPO | Option-3 or option-4 | Option-1 does not make much sense technically.  Option-3 seems similar to Uu case, and option-4 can be seen as the last solution.. |
| Samsung | Option 3 |  |
| Huawei, HiSilicon | Option 4 or 2 | All those work. |
| Kyocera | Option 2 | Agree with Qualcomm. |
| Apple | Option 3 | It is simple to just include all |
| Intel | Option 2 or option 3 |  |
| Lenovo | Option2 or Option3 |  |
| ZTE | See comments | As specified in TS23.304(v17.1.1), NCGI is included in discovery messages to indicate the NCGI of the serving cell of relay UE. In addition, RAN2 agreed to include cellAccessRelatedInfo as a RRC container in Relay’s discovery message. In our understanding, the NCGI and the RRC container (including cellAccessRelatedInfo) are two parameters/fields in discovery message. Remote UE directly reports the NCGI (outer the RRC container) in measurement report but not select a NCGI from cellAccessRelatedInfo. 5.8.3.3 Identifiers for 5G ProSe Layer-2 UE-to-Network Relay The following parameters may be used in Announcement message (Model A) or Response message (Model B) in addition to the parameters as specified in clause 5.8.3.1 for 5G ProSe Layer-2 UE-to-Network Relay (re)selection:  - NCGI: indicates the NCGI of the serving cell of the 5G ProSe Layer-2 UE-to-Network Relay. |
| InterDigital | Option 3 |  |
| Fujitsu | Option 3 |  |

## 2.2 Remaining issue from online session

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| Agreements:  Proposal 7 (modified): If remote UE identifies the target relay UE has changed its serving cell before path switch, remote UE triggers RRC reestablishment as legacy behavior upon expiry of T304 timer, at least for the case of relay UE in RRC\_IDLE/RRC\_INACTIVE. To be determined in [AT117-e][621] how the remote UE identifies that the target relay UE has changed cell and if this can occur in RRC\_CONNECTED.  If RRC\_CONNECTED and RRC\_IDLE/RRC\_INACTIVE cases are differentiated, confirm the working assumption of “UE capability for support by the remote UE of handover to idle/inactive UE.” This refers to a capability of the remote UE itself. If they are not differentiated, check the need for a capability in [AT117-e][621]. |

For the first FFS, i.e., how for remote UE to be aware that the target relay UE has changed cell (compared to the target cell ID included in *reconfigurationwithsync* of the path switching command), if it is not the current serving cell of relay UE, moderator understand

- If remote UE can acquire discovery message before performing path switching operation, it can be aware of that since the cell-ID info is included in the discovery message (although there are argument / concern on the frequency of discovery message, there are still solutions relying UE implementation like remote-UE trigger a model-B discovery solicitation to ask for updated discovery from relay-UE before connection establishment, or relay UE to trigger a model-A discovery as soon as the cell-change is done in order to keep all remote UE being updated);

- Otherwise, e.g., if relay UE performs a cell-change after PC5 connection establishment by a remote UE, it can be handled as normal HO/cell-reselection, i.e., relay-UE uses PC5-RRC message to notify the connected remote UE on this issue;

**Q4-1: Do you think the existing tool(s) (e.g., discovery message, and/or PC5-RRC notification message) are already sufficient for remote to identify the target relay UE has changed the cell?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes | It is sufficient to handle the issue based on what we have agreed for the discovery message and notification message. |
| Sharp | Yes |  |
| Qualcomm | Yes with comments | We share the same view as Rapporteur on the two handlings depending on whether remote UE can acquire discovery before path switch execution.  To be more specific, our understanding on remote UE behaviour is:   1. Upon reception of HO command, remote UE knows the target relay UE is in IDLE/INACTIVE state if dedicated PC5 RLC channel is not included in HO command (i.e., it has to use default PC5 RLC channel to send *RRCReconfigurationComplete*) 2. Then, remote UE checks cell ID in target relay UE’s discovery message via either Model-A or Model-B discovery as mentioned by Rapporteur, and:    * If the cell ID included in discovery message is same as the one in latest measurement reporting for this relay UE, remote UE decides no cell reselection and starts to execute path switch    * Otherwise, if the cell ID is different, remote UE decides that the target relay has performed cell reselection, and so it will trigger RRC re-establishment 3. If relay UE performs cell reselection after PC5 connection establishment by a remote UE, it can notify remote UE via PC5 RRC message.   And please that the above step 2) and 3) are independently performed in parallel with new T304 mechanism (i.e., if remote UE determines target relay UE performed cell reselection in Step 2, it should stop T304 timer). |
| vivo | Partially yes | We think it is possible to rely on the relay UE initiated PC5-S release or PC5-RRC notification to cover **both** the case discussed here **and** the case discussed later in Q5. We don’t necessarily introduce another mechanism intentionally for the case that the remote realizes the cell change of the relay before path switch cmd is received (as in above bullet 1) or introduce another new event for reestablishment, as eventually the key problem is still the relay UE experiences exceptional cases in Uu (which is just what is to be covered by the PC5-S release and PC5-RRC notification based solution).  Thus, we partially agree with above bullet 2 listed by the Rapp (with a revision to add also “PC5-S release” along with PC5-RRC notification). Also, as per our comments to above Q1, we can just incorporate the case here and other cases due to Relay UE’s Uu failure into the same cause value to be included in the PC5-RRC notification.  Or, if the remote UE-identification based solution is finally agreed, we think relying on the existing cell IDs in reconfigWithSync and that in discovery message is already enough. No new signalling is needed. |
| CATT | Yes |  |
| ASUSTeK | Yes |  |
| Samsung | Yes |  |
| Huawei, HiSilicon | Yes | Discovery message should be sufficient. |
| Xiaomi | Yes |  |
| Kyocera | Yes | The existing PC5-RRC notification message already has the cell reselection cause value that can be reused. |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Intel | Yes | Agree that the discovery message is sufficient to handle the case. |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| InterDigital | Yes |  |
| Fujitsu | Yes |  |

For the second FFS, it is about whether the conclusion of proposal-7 above is applicable to relay UE in RRC\_CONNECTED state.

After talk with companies, moderator understand

- The ones support RRC\_CONNECTED state applicability believes that relay UE may undergo a HO during the procedure

- While the opponent believes that the target cell which ACK the HO preparation should not perform the HO for the target relay UE

So different views exist.

**Q4-2: Do you agree the above agreed proposal 7 is also applicable to RRC\_CONNECTED relay UE?**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Sharp | No | We prefer network coordination on this issues, i.e. gNb would not HO the target relay UE if a remote UE has been switched to the relay UE. |
| Qualcomm | No | The root cause for the need of Proposal 7 is due to the ambiguity time interval between measurement report and HO execution when target relay UE is in IDLE/INACTIVE state:   * This time interval is not short, because at least two inter-cell signaling are needed to exchange target cell configuration and prepare HO command (i.e., Handover Request and Handover Request Acknowledgement). Generally, these message exchanges between two cells need more than 40ms latency. * During this interval, a relay UE is in IDLE/INACTIVE state can’t inform gNB on its leave, which will cause ambiguity.   Then if target relay UE is in CONNECTED state, the above ambiguity time interval doesn’t exist because relay UE is totally under gNB control. And we don’t think target cell will HO this target relay UE to another cell after it provides the HO command to source cell. In comparison with procedure when target relay is in IDLE/INACTIVE state of Q4-1, we list our understanding on remote UE behaviour when target relay is CONNECTED state:   1. Upon reception of HO command, remote UE knows the target relay UE is in CONNECTED state if dedicated PC5 RLC channel is included in HO command to send *RRCReconfigurationComplete* 2. Then, remote UE directly executes path switch, without checking the cell ID checks cell ID in target relay UE’s discovery message. 3. If relay UE detects Uu RLF or HO to another cell after PC5 connection establishment by a remote UE, it can notify remote UE via PC5 RRC message, which is existing procedure.   As we can see, remote UE behaviour in step 2) are different between IDLE/INACTIVE relay UE and CONNECTED relay UE. And for some issue raised by some company (e.g. Relay UE detects Uu RLF), it is handled by existing procedure and no need to introduce Proposal 7. |
| vivo | No | Since path switch to RRC\_CONNECTED is fully controlled by the NW, we would trust NW to avoid any exceptional case, and regard the case being discussed here as a corner case (if really possible to happen at all) |
| ASUSTeK | See comment | For relay UE in RRC\_CONNECTED, we think this should be a rare case for gNB to handover the target relay UE. Even if this occurs, remote UE can trigger RRC reestablishment as for relay UE in RRC\_IDLE/INACTIVE upon expiry of T304 timer. |
| Samsung | No | For RRC\_CONNECTED Relay UE’s cell change, we think that it is enough to apply the already agreed procedure i.e., notification message transaction between the target Relay UE and Remote UE via PC5 and the procedure in proposal 7 is not needed. We also think that gNB should control target Relay UE in RRC\_CONNECTED to avoid such an exceptional case. |
| Huawei, HiSilicon | No  But see comments. | gNB will not handover target relay UE to another cell.  =============================================  We have some comments on “If RRC\_CONNECTED and RRC\_IDLE/RRC\_INACTIVE cases are differentiated, confirm the working assumption of “UE capability for support by the remote UE of handover to idle/inactive UE.”  The only new behaviour compared with connected mode is “trigger RRC re-establishment upon relay UE switching cell”. Even if remote UE does not support this, it is not a good idea for remote UE to report “not support handover to idle/inactive UE.”  In case some candidate connected relay UEs are available, there is no issue, since gNB will not handover remote UE to the idle/inactive relay UE.  **In case IDLE/inactive relay UEs are the only available candidate:**   * Not supporting “trigger RRC re-establishment upon relay UE switching cell”, but supporting “handover to idle/inactive UE” will only result in HO failure and then RRC re-establishment as legacy **in such rare case** (relay UE switching cell in such short duration). The only issue is on latency. * But, not supporting “handover to idle/inactive UE” will give gNB the only choice to wait for RRC re-establishment at direct link, while **gNB cannot even try to handover remote UE to idle/inactive relay UE (even though relay UE switching cell is rare case).**   So, this is actually not one UE capability, it is “UE preference indication” of not preferring to be handover to IDLE/INACTIVE relay UE. |
| Xiaomi | No | If relay UE is in RRC\_CONNECTED, NW can refrain from handover until remote UE performs successful path switch. |
| Kyocera | No | We assume the HO preparation would not go through for the target relay UE. |
| Ericsson | Yes | What the network decides is up to network implementation and is not specified in the spec. From this point of view, a network implementation may decide to handoff the relay UE anyway to another cell because the Uu link is going to be broken soon.  There is no benefit for the network to keep a UE with which it cannot transmit and even if this is going to happen the UE will go to IDLE by itself (since the inactivity timer or some other RLF trigger will kick in). If this is the outcome, then we will fall back to the IDLE and INACTIVE case scenario.  In this case, in a way or another the relay UE will disappear as for the IDLE and INACTIVE case.  But regardless of this, the behaviour of the remote UE is the same as it will get anyway a notification from the relay UE. We do not see any difference between the two cases. |
| Apple | No | We think this is a corner case. Even if this happens, the remote UE and relay UE can solve it with some PC5 messages as discussed for IDLE/INACTIVE case. |
| Intel | No with comments | We agree with the procedure outlined by Qualcomm in that if the Remote UE becomes aware at the time of receiving the path switch command that the Relay UE is in connected, it might not perform discovery to check whether the Relay UE is still in the same serving cell and try to directly establish PC5 connection.  It is rare that between the time that the path switch command is received and PC5 connection establishment is initiated that the gNB hands over the Relay UE to another cell. In any case, our understanding is that Remote UE behavior could be that of proposal 7 or action upon reception of HO notification from the Relay UE depending on the time line. There is some differentiation to be made for the idle/inactive vs. connected cases.  As for the UE capability for support, we think it is beneficial for the remote UE to have this flexibility in implementation. |
| Lenovo | No | We think it is corner case. |
| ZTE | See comments | We also have concern on “If RRC\_CONNECTED and RRC\_IDLE/RRC\_INACTIVE cases are differentiated, confirm the working assumption of “UE capability for support by the remote UE of handover to idle/inactive UE.”  Though the remote UE behaviour switching to idle/inactive relay UE has minor difference from switching to connected relay UE, there is no new feature or new capability that remote UE needs to support. E.g. “trigger RRC re-establishment upon relay UE switching cell” is already supported by remote UE, it is not a new feature for remote UE to support.  On the other hand, in case only idle/inactive candidate relay UEs are available, it makes no sense for remote UE to report both idle/inactive candidate relay UEs and capability of “not support handover to idle/inactive UE”. Anyway, we don’t think such UE capability is needed. |
| InterDigital | No | Network should handle this case. |
| Fujitsu | No | Agree with Qualcomm. |

Since the need of capability somehow depends on the output of Q4-2 above, one need to check the need of capability as well.

Moderator understand although P7 is one of the reason for capability for RRC\_IDLE/RRC\_INACTIVE case, the proponent may be thinking more than that as well.

**Q4-3: In case the output of Q4-2 is it is applicable to RRC\_CONNECTED relay UE as well, do you see any other reason to confirm the WA for“UE capability for support by the remote UE of handover to idle/inactive UE.”? If yes, what is it?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Sharp | No |  |
| Qualcomm | Yes | 1. Another different remote UE behaviour is that it needs to implement using default PC5 RLC channel to send *RRCReconfigurationComplete*. Please note in other agreed scenario to use default PC5 RLC channel (i.e., reception of *RRCReestablishement/RRCResume* message), remote UE just needs to implementing using default PC5 RLC channel for reception. In simple word, only direct-to-indirect path switch needs remote UE to implement **transmission** via default PC5 RLC channel, but all other scenarios only need remote UE to implement **reception** via default PC5 RLC channel.  2. We also think the procedure for remote UE to get its local ID in PC5 SRAP header are different between IDLE/INACTIVE relay UE and CONNECTED relay UE. As a copy from our contribution (R2-2202185), the different procedures can be illustrated in below Figure. 1 and Figure.2:    **Figure.1: Illustration of remote UE ID assignment procedure when target relay UE in CONNECTED**    **Figure.2: Illustration of one possible remote UE ID assignment procedure when target relay UE in IDLE/INACTIVE**  3. Because we have quite limited time to close these issues and it is a new thing that target relay can be in IDLE/INACTIVE, we are not sure whether any issue will be raised in remote UE implementation. It may cause IODT issues and slow down the time to market. Thus, we need this UE capability, to avoid possible IODT issues. |
| Kyocera | Yes | We think procedurally, there are some differences for the UE to support path switch to a target relay UE in IDLE/INACTIVE. For remote UE’s that are only capable of supporting CONN relay UEs, it should be possible for the remote UE to know the RRC state of the relay UE to reduce what’s included in the MR. |
| Apple | See comment | If remote UE has an optional capability for this, we strongly suggest to allow remote UE to filter measurement reports of relay UE candidates to not measure and report relays in IDLE/INACTIVE state, which will provide much more savings than the failure handling procedures. |
| Intel | Yes | It offers flexibility for the Remote UE implementation to support only RRC\_CONNECTED Relay UEs when supporting certain applications to ensure minimum switching latency. |
| Lenovo | No | We don’t see the need to have it. |
| ZTE | See comments | As we commented in above, Though the remote UE behaviour switching to idle/inactive relay UE has minor difference from switching to connected relay UE, there is no new feature or new capability that remote UE needs to support. E.g. “trigger RRC re-establishment upon relay UE switching cell”, “using default PC5 RLC channel” are already supported by remote UE, it is not a new feature for remote UE to support. Also, get remote UE local ID from RRCReconfiguration is not a new feature for relay UE.  On the other hand, in case only idle/inactive candidate relay UEs are available, it makes no sense for remote UE to report both idle/inactive candidate relay UEs and capability of “not support handover to idle/inactive UE”.  Anyway, we don’t think such UE capability is needed. |
| InterDigital | Yes | We have the same understanding as QC, so we think this capability is needed. |

|  |
| --- |
| Proposal 8: When the new T304-like timer is stopped in remote UE but the direct to indirect path switch fails due to IDLE/INACTIVE relay UE fails to establish the connection on Uu hop of indirect path, a similar handling as relay UE’s HO/Uu RLF, i.e.:  -Upon relay UE receives RRCReject or experiences other connection establishment/resume failure, it either triggers PC5-S release or sends notification message indicating Uu RRC connection failure to remote UE.  -PC5-S release or notification message shall trigger remote UE’s RRC reestablishment. But in case of notification, remote UE can choose to keep the current PC5 connection with this target relay, or release the PC5 connection and reselect to other relay.  Agreement:  Proposal 8 above will be handled in [AT117-e][621]. |

Moderator understand that based on the discussion in R2-2202356 Q3.2-2, the ones selected option-2/3/6 are 19 out of 23, i.e., clear majority, and thus it should be straightforward to confirm the P8 here. Where the only left issue is the need of new cause value, which has been addressed by Q1 above.

**Q5: Do you agree with the above proposal 8?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes |  |
| Sharp | Yes |  |
| Qualcomm | Yes |  |
| vivo | Yes with comments | First, as we commented in Q1, we don’t think another new cause value, e.g. “RRCReject”, needs to be introduced. Instead, incorporating possible exceptional cases as “Uu link failure” and “Relay Mobility” is sufficient. This is because, for all these operations, same handling applies, so no motivation to further distinguish the specific causes.  Then, if PC5-S release procedure is applied as proposed above, we need to confirm that in L2 relay case, the relay initiated PC5-S release would have to trigger the RRC\_CONNECTED remote UE to perform **both** the release of the relay specific unicast link **and** RRC Reestablishment (not only the PC5-S link release as in the legacy), as no cause value is supposed to be introduced into PC5-S message. |
| CATT | Yes |  |
| ASUSTeK | Yes (with Question) | The relay UE’s behaviour is not clear to us. Does this proposal mean it is relay UE implementation whether to trigger PC5-S release or send notification message indicating Uu RRC connection failure to remote UE? |
| Samsung | Yes |  |
| Huawei, HiSilicon | Yes | This should be one new cause value. |
| Xiaomi | Yes |  |
| Kyocera | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes with comment | However, it is not clear to us why Uu link establishment from the relay UE will be rejected by gNB. Receiving RRCReject is quite uncommon in this case. So, if not rejected directly by gNB, we still need describe the conditions of triggering this notification/release. |
| Intel | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes with comments | As in Q1, we don’t think a new cause value is needed. |
| InterDigital | Yes |  |
| Fujitsu | Yes |  |

# Proposals that have been covered by Pre-117 discussion or can be deprioritized

|  |  |  |  |
| --- | --- | --- | --- |
| **Tdoc number** | Company | Proposal | Moderator comment |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 1: The stop condition of the new T304-like timer in direct-to-indirect path switch is upon successfully sending RRCReconfigurationComplete (i.e., lower layer acknowledge is received from target relay). | The discussion related to this issue has already been covered in pre-117 [603] |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 2: RAN2 confirm that relay UE in RRC\_CONNECTED reports its source L2 ID for relay discovery to gNB via SUI in the following 3 cases:  Determine to support L2 relaying and initiate discovery  Determine to stop L2 relaying support and suspend discovery  Link layer ID updated due to any reason | The discussion is already been covered in pre-117 [604] |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 3: Remote UE in RRC\_CONNECTED state can perform autonomous relay reselection in below cases:  Upon detection of PC5 RLF towards relay UE  Upon reception of Uu RLF notification in PC5 RRC message from relay UE  Upon reception of relay UE HO notification in PC5 RRC message from relay UE  Upon reception of PC5-S message for release from relay UE | Already covered in spec (300) as follows  The U2N Remote UE may trigger U2N Relay reselection in following cases:  - PC5 signal strength of current U2N Relay UE is below a (pre)configured signal strength threshold;  - Cell (re)selection, handover or Uu RLF has been indicated by U2N Relay UE via PC5-RRC signalling  - When Remote UE receives a PC5-S link release message from U2N Relay UE  - When U2N Remote UE detects PC5 RLF  - Indicated by upper layer. |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 4: RAN2 confirm that gNB sends remote UE local ID in RRC Reconfiguration message towards both remote UE and target relay UE in CONNECTED sate when preparing the direct-to-indirect path switch. And remote UE local ID is included in both Uu and PC5 SRAP header of RRCReconfigurationComplete message | The intention of this proposal is already agreed. |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 5: When target relay UE is in IDLE/INACTIVE state for direct-to-indirect path switch, remote UE local ID is assigned via below procedure:  Remote UE local ID is NOT included in RRC Reconfiguration message towards both remote UE  PC5 SRAP header is absent when remote UE sends RRCReconfigurationComplete message  After target relay UE enters CONNECTED state (upon reception of RRCReconfigurationComplete message), it requests remote UE local ID via SUI message | The discussion is already been covered in pre-117 [604] |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 6: When target relay UE is in IDLE/INACTIVE state for direct-to-indirect path switch, the path switch command can include remote UE’s upper layer configuration (PDCP and above) prepared by target cell. | There is no difference between relay UE in RRC\_CONNECTED and in RRC\_IDLE/INACTIVE, and the signalling in running-CR already allows this. |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 7: If remote UE can’t find the target IDLE/INACTIVE relay UE’s L2 ID after reporting before path switch, it directly declares path switch failure, and triggers RRC re-establishment. | No difference between RRC\_CONNECTED relay UE and RRC\_IDLE/INACTIVE relay UE, and moderator assume it is handled as T304 expiry case. |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 8: If remote UE find that the target IDLE/INACTIVE relay UE has reselected to another cell after reporting before path switch, it directly declares path switch failure, and triggers RRC re-establishment. | No difference between RRC\_CONNECTED relay UE and RRC\_IDLE/INACTIVE relay UE, and it is covered by post-116b 603. |
| [**R2-2202185**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202185.zip) | Qualcomm Incorporated | Proposal 10: Confirm the WA of UE capability for support by the remote UE of handover to idle/inactive UE | The discussion is already been covered in pre-117 [603] |
| [**R2-2202341**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202341.zip) | OPPO | Proposal 2: RAN2 not pursue further optimization on when for remote UE to stop receiving the DL data forwarded by relay-UE, i.e., it can be upon the reception of PC5-RRC signalling (i.e., RRCReconfigurationSidelink) from relay UE which release the bearer. |  |
| [**R2-2202380**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202380.zip) | ZTE, Sanechips | Proposal 1: It is suggested to capture the Figure 1, i.e. the signalling procedure for Remote UE switching to an indirect path via a RRC\_IDLE/INACTIVE Relay UE, into stage 2 specification. | It is a very detailed issue, up to running-CR to handle |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 1 L2 U2N Relay UE reports its Src L2 ID to the serving gNB, when one of the following two conditions is satisfied:  Relay UE enters RRC\_CONNETED from IDLE/INACTIVE state; or  RRC\_CONNECTED relay UE change its Src L2 ID. | The discussion is already been covered in pre-117 [604] |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 2 L2 Relay UE optionally reports the last used Src L2 ID in SUI message, along with its latest Src L2 ID. | The discussion is already been covered in pre-117 [604] |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 3 If a L2 remote UE is directly connected to gNB and has not chosen a Src L2 ID for relay discovery, the UE generates the Src L2 ID to be used in potential SL discovery procedures and report it to gNB.  Proposal 5 RAN2 send LS to SA2/CT1 to inform the requirement of Src L2 ID assignment of Layer 2 remote UE directly connected to gNB. | Moderator suggest to down-prio this one as an optimization. |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 4 L2 remote UE triggers the report of remote UE ID whenever the Src L2 ID changes. | The discussion is already been covered in pre-117 [604] |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 6 When gNB detects the reported Src L2 ID of L2 U2N relay UE is in conflict with another relay UE connected to the same cell, the gNB either 1) assigns a different Src L2 ID for the relay UE to be used in relay discovery procedure; or 2) triggers relay UE ID to self-choose a different Src L2 ID. | Moderator suggest to down-prio this one as an optimization. |
| [**R2-2202545**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202545.zip) | Apple | Proposal 7 RAN2 to discuss the solution to prevent the establishment of PC5 link to the wrong target relay UE in IDLE/INACIVE state, e.g. with the enhancement of DCR message. | This proposal aims at “the DCR (Direct Communication Request) message is to be amended to contain the “HO target cell” information” - Moderator suggest to down-prio this one as an optimization. |
| [**R2-2202584**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202584.zip) | Lenovo, Motorola Mobility | Proposal 1: The remote UE needs to stop receiving the DL data from the relay after reception of path switching command from gNB. | Moderator understand this issue can be already solved based on the PC5-RRC signalling from relay-UE to remote-UE to release the related RLC channel, i.e., the DL reception is stopped upon that procedure. |
| [**R2-2202584**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202584.zip) | Lenovo, Motorola Mobility | Proposal 2: UE stops T304 when the remote UE receives RRCReconfigurationCompleteSidelink message. | The discussion related to this issue has already been covered in pre-117 [603] |
| [**R2-2202584**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202584.zip) | Lenovo, Motorola Mobility | Proposal 3: Once idle/inactive relay UE is rejected by the serving cell, the relay UE transmits the notification message to the remote UE. Once the remote UE receives the notification, the remote UE initiates re-establishment procedure. | The discussion related to this issue has already been covered in pre-117 [603] |
| [**R2-2202738**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202738.zip) | NEC Corporation | Proposal 1 RAN2 to adopt the Option 1, i.e. remote UE compares the ID of its source SpCell and the ID of the cell serving the target relay UE, i.e. the target SpCell.  Proposal 2 RAN2 to adopt the proposed changes in the Annex below to the running RRC CR for SL Relay. | Moderator understand the related steps are not used for relay-case, i.e., direct-to-indirect switching. |
| [**R2-2203202**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2203202.zip) | Sony | Proposal 1: RAN2 to agree that Conditional handover is supported for switching from direct to indirect path as well as switching from indirect to direct path. Rel-16 CHO procedure is the baseline. | Moderator suggest to down-prio this issue before finishing the basic design of normal-HO. |
| [**R2-2203202**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2203202.zip) | Sony | Proposal 2: Remote UE’s security contexts should be kept even when it has an associated relay UE. | Moderator assume that is supported based on legacy behaviour at Uu-PDCP layer. |

# Summary

# Reference

1. R2-2202185 Remaining issues on service continuity of L2 U2N relay Qualcomm Incorporated
2. R2-2202341 Left issue on NR sidelink relay service continuity OPPO
3. R2-2202356 Report of [Pre117-e][603][Relay] Open Issues on Relay Service Continuity (CATT) CATT
4. R2-2202380 Remaining issues on service continuity ZTE, Sanechips
5. R2-2202545 Discussion on remaining issues for direct-to-indirect path switch Apple
6. R2-2202584 Path switching in L2 U2N relay case Lenovo, Motorola Mobility
7. R2-2202738 RRC corrections on path switch NEC Corporation
8. R2-2202821 Stage3 issue on NCGI reporting in measurement result Huawei, HiSilicon
9. R2-2202848 Potential issues on multiple PDU sessions handling during U2N direct to indirect path switching ASUSTeK
10. R2-2203202 Service continuity open issues in L2 NR sidelink relay Sony