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

Online, 21 Feb – 03 Mar 2022

**Agenda item: 8.7.2.1**

**Source: Huawei, HiSilicon**

**Title: Summary of [Pre117-e][605][Relay] Open issues on relay control plane procedures (Huawei)**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the summary report of [Pre117-e][605][Relay] Open issues on relay control plane procedures (Huawei).

# 2 Contact Points

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Xiaomi | Xing Yang | Yangxing1@xiaomi.com |
| Qualcomm | Peng Cheng | chengp@qti.qualcomm.com |
| Apple | Zhibin Wu | Zhibin\_wu@apple.com |
| InterDigital | Martino Freda | martino.freda@interdigital.com |
| OPPO | Bingxue | lengbingxue@oppo.com |
| Intel | Sangeetha | sangeetha.l.bangolae@intel.com |
| CATT | Hao Xu | xuhao@catt.cn |
| CMCC | Xueyan HUANG | huangxueyan@chinamobile.com |
| Nokia | Gyuri Wolfner | gyorgy.wolfner@nokia.com |
| Sharp | Chongming | Chongming.zhang@cn.sharp-world.com |
| vivo | Boubacar Kimba | kimba@vivo.com |
| Spreadtrum | Shannen cao | Shannen.cao@unisoc.com |
| Fujitsu | Guorong Li | liguorong@fujitsu.com |
| Ericsson | Antonino Orsino | antonino.orsino@ericsson.com |
| ZTE | Lin Chen | chen.lin23@zte.com.cn |

# 3 Discussion

The CP open issues classified as “Pre-117 discussion” in R2-2201721 are listed as below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Issue Index** | **Description** | **Suggested handling** | **Reason for add/remove this open issue** |
| O6.03 | [Unhandled issue from RAN2#116b summary] Cause value setting for relay UE access due to remote UE traffic | Pre-117-e-offline | Due to the proposal made in CP A.I. summary:  Recommendation 3-1: RAN2 further discuss to select between using existing or new cause value for relay UE to establish/resume an RRC connection due to a connection of remote UE, without introducing new AS-layer signalling from remote UE to relay UE.  We have the corresponding open issue |
| O6.04 | [Unhandled issue from RAN2#116b summary] Whether/how to support MIB related field forwarding, e.g., cellBar | Pre-117-e-offline. | Due to the agreement made in RAN2 #116bis:  Recommendation 1-1a [19/23]: RAN2 not pursue new signalling from remote UE to relay UE to indicate the interested SI(s).  Recommendation 1-1b [19/23]: RAN2 not pursue short message forwarding from relay UE to remote UE.  Recommendation 1-1c (modified): For SIB-update in case of RRC\_IDLE/RRC\_INACTIVE remote UE(s), rely on relay UE to send updated SIB(s) to remote UE, no new signalling is to be introduced [17/23]. For SIB-update in case of RRC\_CONNECTED remote UE(s), rely on network to send updated SIB(s) when they are updated, no further restriction in specification [15/23]. Remote UE de-configure SI-request w.r.t relay UE implicitly when entering into RRC\_CONNECTED state [10/13].  Recommendation 1-2 [22/23]: For which discovery message to use to carry cellAccessRelatedInfo, rely on SA2 to decide which discovery message to use.  Recommendation 1-3 [19/23]: For SIB1, both request-based delivery (i.e., SIB1 request by the remote UE) and unsolicited forwarding are supported, of which the usage is left to relay UE implementation.  Recommendation 1-4 [20/23]: For SIB1, it is carried via PC5-RRC message of UuMessageTransferSidelink.  This open issue only left with an open issue on MIB. |
| O6.14 | [Open issue from tdoc R2-2201508] FFS on the handling of *useT312* | Pre117-e-offline | Due to the proposal in R2-2201508 related 38.331 stage-3 open issue:  Proposal 3: useT312 can be configured to event Y (on condition that no other spec impact), but cannot be configured to event X.  We have the corresponding open issue. |
| O6.19 | [Unhandled issue from comment]Whether to include PCI in suspendconfig | Pre117-e-offline | Based on the agreement  Recommendation 4-1 [20/20]: Deliver C-RNTI value via RRC Release message with suspendConfig.  Rapp understand it is reasonable to align for PCI as well |
| O6.20 | [Unhandled issue from RAN2#116b summary] FFS on the configuration of LCID for PC5 RLC channel of Uu SRB1, SRB2 and DRBs. | Pre117-e-offline | To address the following left issue from pre-116b summary  Proposal 11 (low priority) Regarding how to allocate LCID for PC5 RLC channel of remote UE Uu RBs including SRB2 and DRBs, RAN2 to down select the following options. FFS on SRB1  a. Option 1: allocated by UE same as in R16 SL  b. Option 2: up to gNB dedicated configuration same as in Uu |
| O6.21 | [Unhandled issue due to comment]Whether SRAP configuration can be stored as AS context | Pre117-e-offline | Due to company feedback |
| O6.22 | [Request from RAN3 in LS] feasibility to change the current running CR by indicating the Uu RLC Channel ID instead of LCID when configuring “sl-Egress-RLC-Channel-Uu-r17” | Pre117-e-offline | During RAN3#114bis meeting, an LS (R3-221411) on bearer mapping configuration was sent from RAN3 to RAN2 and ask RAN2 to use Uu RLC Channel ID to indicate the egress RLC channel.  **Is it feasible for RAN2 to change the current running CR by indicating the Uu RLC Channel ID instead of LCID when configuring “sl-Egress-RLC-Channel-Uu-r17”?**  RAN2 is suggested to further discuss the specification impact. |

**3.1 Cause value setting for relay UE access due to remote UE traffic**

According to previous RAN2 discussion, there are two options for cause value setting when Remote UE’s msg3 triggers Relay UE entering RRC\_CONNECTED mode as captured in LS to CT1.

* Option 1: define a new establishment/resume cause value that is used for all cases when a relay UE establish/resume an RRC connection due to a connection of remote UE;
* Option 2: reuse existing establishment/resume cause values.

The main benefit of option 2 is it can reflect the real access cause of the remote UE so that the NW can determine if the access attempt from relay should be accepted in case of congestion; while option 1 cannot, and the consequence would be that NW accepts the relay UE’s access but may reject the remote UE after seeing the real access cause in remote UE’s msg3 which introduces unnecessary signalling overhead. One could argue that option 1 allows NW to differentiate relay UE based on the new cause value, but the moderator understands there is no need to differentiate relay UE at this time point. Because after the Relay UE entering RRC\_CONNECTED state it needs to request Remote UE’s local ID before forwarding Remote UE’s msg3, when NW should provide the configuration of Uu SRAP and Uu RLC channel to carry this Remote UE’s SRB message.

Considering above, it seems reasonable that relay UE sets its cause value in msg3 to reflect the real access cause of the remote UE.

**Question 1: Do companies agree that the cause value in relay UE’s msg3 should reflect the remote UE’s access cause?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Xiaomi | Yes | Agree with Rapp.  Furthermore, we understand this question only applies to the case that relay UE doesn’t have its own service on Uu. Otherwise, legacy procedure applies. |
| Qualcomm | Yes |  |
| Apple | Yes | Same view with Xiaomi |
| InterDigital | See comment | We think whether to reflect the remote UE’s access cause will depend on the access itself (e.g. whether emergency access). There is still benefit in the network knowing that a relay’s access is for a remote UE’s traffic rather than its own to make access decision immediately at MSG3 reception by the NW. |
| OPPO | No | We are fine to use an existing value (option) but cannot accept this “the cause value in relay UE’s msg3 should reflect the remote UE’s access cause”.  The fact is the single cause value in relay UE’s msg3 **cannot reflect the real remote UE’s access cause** considering the issue of different values / RRC-state from different remote UEs (i.e., 1) due to different RRC procedure and thus different cause value to be used by remote UE and by relay UE, 2) due to different RRC procedure and thus different cause values to be used by different remote UEs access simultaneously towards relay UE). Therefore, the consequence will be:   * The saying benefit “reflect the real access cause of the remote UE” is not achieved; * More discussions/debates/spec efforts (all the questions in 3.1.1) are needed for this direction.   So considering the limited time, we are fine to use existing value and leave the setting of exact value to UE implementation(which is the same behaviour as IAB) as a compromise.  We do not see a reason to deviate from the majority view as output from 116bis as follows |
| Intel | Yes | Agree with moderator’s view, understanding that there will be deviation when multiple Remote UEs request access at the same time and for the case of reestablishment and RNAU. |
| CATT | No | Agree with OPPO. If relay UE use remote UE’s cause value, gNB may reject the relay UE with wait time due to low priority cause value. Then another remote UE with high priority cause value accesses to the network via this relay UE, the relay UE can’t initiate RRC setup procedure since T302 is running. |
| MediaTek | No | From access control perspective, in general, we did not see the value to apply the Remote UE’s cause value to Relay UE during Relay UE’s Uu RRC connection establishment.  Let us take a look at the following procedure for L2 relay based access:  (1) The U2N Remote UE sends the first RRC message (i.e., SRB0 message, e.g. RRCsetup request) for its connection establishment with gNB via the Relay UE, using a specified PC5 RLC channel configuration. If the U2N Relay UE is not in RRC\_CONNECTED, it needs to do its own connection establishment upon reception of a message on the specified PC5 RLC channel.  (2) gNB performs access control for Relay UE based on the cause value received from Relay UE. If it passes the AC, go to next step  (3) Then gNB further performs access control for Remote UE based on the cause value received from Remote UE. If it passes the AC, go to next step  (4) The gNB configures SRB0 relaying Uu RLC channel to the U2N Relay UE and sends SRB0 response message.  As you can see, there are clear two step access controls in case of Remote UE access, which is in align with the design principle of L2 relay (i.e. RRC message should be transparent to relay node).  If we reflect the remote UE’s access cause within the cause value in relay UE’s msg3, the design principle of L2 relay is actually violated: at every time the Remote UE sends an SRB0 message, the Remote UE needs to send a PC5-RRC message to Relay UE to notify its cause value, or the Relay UE needs to resolve the Remote UE’s Uu RRC message.  Asking the relay UE to extract the cause value from the remote UE’s message apparently violates the design principle of L2 relay.  Furthermore, if putting the Remote UE’s cause value into the Relay UE’s cause value at Uu message, it not only removes the need to take the above two steps based AC at gNB, but also hides the real intention of the connection establishment request from the gNB. |
| CMCC | Yes |  |
| Sony | No | Agree with MediatTek. But we prefer to use a new cause value for Relay UE’s access. |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes | Agree with Rapporteur’s observation. |
| Spreadtrum | No | Same view with MediaTek. In order for a RRC\_IDLE/RRC\_INACTIVE relay UE to establish/resume an RRC connection due to a RRC connection setup/resume/reestablishment by remote UE, use one new cause value for RRC connection setup/resume by relay UE. |
| Fujitsu | No | In case of e.g., the remote UE’s direct-to-indirect path switch, the idle/inactive relay UE would initiate RRC establishment/resumption procedure on receiving the remote UE’s RRCReconfigurationComplete message. In this case, there is no cause value in the remote UE’s RRCReconfigurationComplete message, so the relay UE’s cause value should be determined. |
| Ericsson | Yes | It would be beneficial for the network to differentiate relay from normal Uu traffic. |
| ZTE | No | We think the relay UE may determine its establishment cause value. It does not have to be the same with remote UE. For example, when remote UE re-selects the relay UE for Uu recovery, the cause value in RRCReestablishmentrequest are reconfigurationFailure, handoverFailure and otherFailure. In this case, it does not make sense to set the the establishment/resume cause value of relay UE as reconfigurationFailure / handoverFailure/otherFailure |

3.1.1 If go for the direction that relay UE’s cause value should reflect the remote UE’s access cause i.e. YES to Q1

The discussion point would be how the Relay UE obtain the information on the access cause of the Remote UE. The moderator understands there are two alternatives proposed by companies:

* Alt1: Remote UE sends the cause value to Relay UE via PC5-RRC message;
* Alt2: Relay UE copies the cause value from Remote UE’s msg3.

For the two alternatives, the potential spec impact is summarized as below.

|  |  |
| --- | --- |
|  | Spec impact and UE behaviour |
| Alt1 | New PC5 RRC message needs to be defined to include remote UE’s access cause.  In remote UE side, upon initiation of RRC setup/resume procedure, the UE should include the cause value (received from upper layer or generated by AS layer) to its own msg3 which will be transmitted via the specified SL-RLC0 and to the PC5-RRC message which will be transmitted e.g. via SL SRB1.  In relay UE side, it needs to wait for the PC5-RRC message to set its cause value even though it receives remote UE’s msg3 via SL-RLC0. This means the PC5-RRC message triggers the relay UE’s connection establishment but not the first RRC message from remote UE, which does not align with the previous agreement. |
| Alt2 | No PC5 signalling is needed.  In remote UE side, upon initiation of RRC setup/resume procedure, it sends the msg3 via SL-RLC0 to relay UE. No more action is needed.  In relay UE side, after reception of remote UE’s msg3 via SL-RLC0, it needs to decode the SRB0 message, and get the cause value in that message. |

**Question 2: If your answer to Q1 is yes, on how the relay UE obtain the access cause of the remote UE, which alternative is preferred between Alt1 and Alt2?**

|  |  |  |
| --- | --- | --- |
| Company | Alt1/ Alt2 | Comments |
| Xiaomi | Prefer Alt 1, can accept Alt 2 with comments | Either option can work.  In Alt 1, maybe current PC5 RRC message can be reused rather than new PC5 RRC message.  In Alt 2, we think it can work. But following impact is observed,   1. This method breaks the protocol design of L2 relay. As depicted in protocol stack of L2 relay, remote UE’s Uu RRC message is supposed to be transparent to relay UE. Protocol stack should change to include Uu-RRC layer in relay UE. 2. This method would require relay UE to decode UL RRC message, which is not required for legacy UEs. I’m afraid this may require more capability and put more burden on relay UE.   With the above observed impacts, alt1 seems to be simpler solution. However, if the observed impacts are acceptable to all companies, we can also accept this method. |
| Qualcomm | Alt-2 | Alt-2 seems to be sufficient. Because msg3 is sent via SRB0, there is no security protection and so relay UE can decode it and include in its RRC establishment request message. |
| Apple | Alt-1 | In general, we think the current procedure for the 1st RRC message (Msg 3 in SRB0 and SRB1 “RRCReconfigurationComplete” message) is too “minimal” and does not allow any additional assistance information to be provided to the relay UE.  If a new PC5-RRC message is introduced, it can also be used to solve HO failure case if “target cell ID” can be provided as well as establish cause to the relay UE, so relay UE which has re-select to a different cell can then abort the procedure gracefully.  Also, we agree with Xiaomi. that even the message is not ciphered, the relay UE shall not be encouraged to peek information in E2E RRC signalling. |
| InterDigital | Alt1 or Alt2 | We can accept either alternative. |
| OPPO | None | As replied to Q1, the ultimate benefit cannot be achieved.  For Alt-2, we are wondering any security concern for UE-B to read into UE-A message.. |
| Intel | Alt-1 with comment | We prefer to reuse existing PC5-RRC message if it is possible as it is late in the WI. We agree with Xiaomi’s observation that as per the protocol stack, Uu RRC message from Remote UE is end-to-end terminating at the gNB irrespective of the ciphering. |
| CATT | None | For Alt-1, if the cause value of remote UE is sent to Relay UE via PC5-RRC message, the trigger condition of RRC establishment of IDLE/INACTIVE relay UE should be changed to “the PC5-RRC message includes cause value and any message are received from a L2 U2N Remote UE via SL-RLC0”. Since PC5-RRC message and Msg3 of remote UE are transmitted separately, extra latency will be introduced.  For Alt-2, we also think relay UE can’t decode any E2E RRC signalling of remote UE. |
| MediaTek | None | Both alternatives violate the principle of L2 relay design.  We think a real L2 relay solution should not allow the mix-up between Remote UE’s cause value and Relay UE’s cause value for Uu RRC est. |
| CMCC | Fine with both, prefer Alt-1 | We agree with the analysis of Rapp. |
| Sony | None |  |
| Nokia | Alt 2 |  |
| Sharp | Alt 1 or Alt 2 | No strong opinion. We could go with majority views. |
| vivo | Alt2 | Agree with Qualcomm. |
| Spreadtrum | None |  |
| Fujitsu | None |  |
| Ericsson | Fine with both |  |
| ZTE | None |  |

After the relay UE obtains the cause value of remote UE, it can set its own cause value identical to the remote UE’s cause value. However one special case was pointed out by companies, i.e. remote UE’s RNAU, wherein the relay UE should not use the remote UE’s cause value obviously, otherwise the NW will release the Relay UE by assuming its Relay UE’s 2-step resume. The moderator understands the potential solutions could be either Relay UE uses a new cause value in RRC resume request message for this case or Relay UE uses other existing cause value other than RNAU which can be a specified one or random one chosen by Relay UE itself.

* Alt1: Relay UE uses a new cause value in RRCResumeRequest/RRCSetupRequest to present remote UE’s RNAU.
* Alt2: Relay UE uses an existing cause value other than rna-Update in RRCResumeRequest/RRCSetupRequest.

**Question 3.1: If your answer to Q1 is yes, on how the relay UE set the access cause in case of remote UE’s RNAU, which solution is preferred between Alt1 and Alt2?**

|  |  |  |
| --- | --- | --- |
| Company | Alt1/ Alt2 | Comments |
| Xiaomi | Either is fine for us | If alt2 is adoped, we prefer relay UE to set mo-signalling.  If the request is rejected by gNB, remote UE is not reachable by RAN paging, but could still reachable by legacy paging. There is no critical issue to reject the connection establishment request from relay UE in this case. We propose relay UE to set EstablishmentCause as mo-Signalling in this case. |
| Qualcomm | Alt-1 | At this stage, we think Alt-1 seems to be a more clean way.  If we go for Alt-2, it is better to clearly specify how to map the cause value. It is also acceptable to us. |
| Apple | Alt-1 | A new cause value is a more clean approach. |
| InterDigital | Alt-1 | Agree with Apple. |
| OPPO | None | We do not see the gain from this additional spec effort at the last minute |
| Intel | Alt-2 preferred; Alt-1 is acceptable if majority prefer | We think that it is late in the WI to be defining a new cause value for the Relay UE to use. It is also possible that multiple Remote UEs are requesting access at this time and anyways up to Relay UE on how to handle that scenario. |
| CATT | Alt-1 |  |
| MediaTek | None | 1. We do not see the gain from this additional spec effort at the last minute 2. There is no essential difference between RANU case and connection establishment case 3. We did not see the reason and need for Relay UE to resolve the Remote UE’s RRC message. |
| CMCC | Alt-1 |  |
| Sony | None |  |
| Nokia | Alt2 | As there are limited number of spare values, we should avoid using a new one unless it is absolutely necessary. Using e.g., "MO-Signalling" well describes the reason of the request. |
| Sharp | Alt-1 |  |
| vivo | Alt-2 | For simplicity, we suggest to set *mo-signalling* in case of remote UE’s RNAU. |
| Spreadtrum | None |  |
| Fujitsu | None |  |
| Ericsson | Alt-2 | Agree with Nokia |
| ZTE | None |  |

**Question 3.2: If your answer to Q1 is yes, do you agree that relay UE should set the same cause value identical to remote UE’s for the cases other than remote UE’s RNAU?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Xiaomi | Yes if possible | We also see another case, i.e. remote UE trigger re-establishment, where relay UE can’t set identical cause value as remote UE.  **We discussed this issue in R2-2200795, following proposals are given. We are open to other opinions as long as UE behaviour is clear.**  Another case is remote UE initiates reestablishment procedure and relay UE initiates establishment/resume procedure, there is no corresponding *EstablishmentCause* or *ResumeCasue* for reestablishment. gNB is not expected to reject the reestablishment request. To ensure the successful access, relay UE shall set the *EstablishmentCause* or *ResumeCasue* by a high priority value. Also, there may be service terminated at remote UE before reestablishment. We propose to use *mt-Access* as cause value in this case.  **Proposal 4: Relay UE set *EstablishmentCause* or *ResumeCause* as *mt-Access* if RRC establishment or resume is triggered by remote UE’s reestablishment.**  Furthermore, companies ask how to set cause value if multiple remote UEs trigger relay UE’s establishment/resume. We understand it is rare case that messages from multiple remote UEs arrive at relay UE at the same time. Relay UE set the cause value according to the earliest message from remote UE. Even if this corner case happens, it’s up to relay UE to select which cause value to use from the multiple remote UEs.  **Proposal 3: It’s up to relay UE to select which cause value to use from the multiple remote UEs, if messages from multiple remote UEs arrive at relay UE at the same time.** |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| InterDigital | No | There could be other remote UE cause values where using a new cause value would be beneficial. |
| OPPO | None | We do not see the gain from this additional spec effort at the last minute |
| Intel | Yes |  |
| CATT | No |  |
| MediaTek | None | We do not see the need from this additional spec effort at the last minute |
| CMCC | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| Spreadtrum | No |  |
| Fujitsu | No |  |
| Ericsson | Yes |  |
| ZTE | No |  |

3.1.2 If go for direction that relay UE’s cause value does not reflect the remote UE’s access cause, i.e. NO to Q1

The question next would be whether a new cause value needs to be defined for relay access. Otherwise one possible way could be the relay UE’s implementation can choose a cause value from the existing cause values.

* Alt1: introduce a new cause to indicate relay specific access.
* Alt2: reuse the existing cause value, and leave it to relay UE’s implementation on how/which cause value to choose (i.e. no spec impact).

**Question 4: If your answer to Q1 is no, which alternative is preferred between Alt1 and Alt2?**

|  |  |  |
| --- | --- | --- |
| Company | Alt1/ Alt2 | Comments |
| InterDigital | Alt1 | See responses to previous questions – this allows NW differentiation of the access between remote and relay UE traffic. |
| OPPO | 1, 2 are both fine | Both fine for us, can follow majority view. |
| CATT | Alt1 or Alt2 | For Alt2, which cause value (e.g. mo-signalling) is used for relay UE access should be described in the specification. |
| MediaTek | Alt2 |  |
| Sony | Alt1 |  |
| Spreadtrum | Alt1 |  |
| Fujitsu | Alt1 |  |
| ZTE | Alt 2 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Question 5: If your answer to Q4 is Alt1, which layer is responsible to provide the cause value, i.e. NAS layer or RRC layer?**

|  |  |  |
| --- | --- | --- |
| Company | NAS/ RRC | Comments |
| InterDigital | RRC | We think a new cause value is fully RRC related and NAS does not need to be involved. |
| OPPO | Both are fine |  |
| CATT | RRC |  |
| MediaTek | RRC | This can be UE implementation |
| Sony | RRC |  |
| Spreadtrum | RRC |  |
| Fujitsu | RRC |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

3.1.3 Summary of the solutions

To sum up, there are following alternatives as blow:



This point has been discussed for several times and no consensus can be achieved due to diverse company views. In order to conclude this issue in the last meeting, the following question is to collect companies views on which solutions can be accepted.

**Question 6: Among the above solution 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 4, which solutions are acceptable?**

|  |  |
| --- | --- |
| Company | Answer (One or more solutions among solution 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 4) |
| Xiaomi | Solution 4 is not acceptable, since it doesn’t work. Relay UE have no information to set the existing cause value appropriately. This solution would jeopardize the access control framework, i.e. cause value and real access attempt would be independent. |
| Qualcomm | 2.1 and 2.2: no new PC5 RRC signaling is needed if existing one is used  3.2: if a new cause value is introduced, we don’t prefer to trigger CT1/SA2 work. Then we only accept RRC generate the cause value. |
| Apple | Solution 1.1 > Solution 2.1. We do not accept solution 3 and solution 4. |
| InterDigital | Solution 1.1 > Solution 2.1. We think the final solution can also be a mix between 1.1/1.2, and 3.2, where we use 1.1/1.2 for emergency cause values, and use solution 3.2 for non-emergency cause values. |
| OPPO | Solution 3.1, 3.2 and 4. We do not accept solution 1 and solution 2. |
| Intel | Solution 1.2 for RNAU and use existing values for other cases. We could consider existing PC5-RRC message as well. We are not sure how solution using msg3 works given the protocol stack. |
| CATT | Solution 3.2 and 4. We do not accept solution 1 and solution 2. |
| MediaTek | Solution 4. We object solution 1 and solution 2. |
| CMCC | We prefer Solution 1.1, solution 2.1 is also acceptable. |
| Sony | Solution 3.2 |
| Nokia | Solution 2.2 is the preferred option  Solution 4 and Solution 1.2 are acceptable |
| Sharp | Solution 1.1 is the preferred. Solution 2.1 is also acceptable. |
| vivo | Solution 2.2.  It is noticeable that all the solutions on the table are working out the special case that relay UE doesn’t have its own service on Uu but only for relaying purpose. However, we think the other case that relay UE has its own service on Uu along with relaying purpose is more common. From this perspective, the specification efforts for such special case should be minimized with best efforts, i.e., no new PC5 RRC signalling and no new cause value. |
| Spreadtrum | We prefer solution 3.2, and 4 is also acceptable. |
| Fujitsu | We prefer solution 3.2. |
| Ericsson | Solution 2.2 is the preferred option  Solution 1.1, 1.2 and 2.1 are also acceptable |
| ZTE | Solution 4 is acceptable. |

**3.2 Whether/how to support MIB related field forwarding, e.g., cellBar**

In MIB, the following information is included:

MIB ::= SEQUENCE {

systemFrameNumber BIT STRING (SIZE (6)),

subCarrierSpacingCommon ENUMERATED {scs15or60, scs30or120},

ssb-SubcarrierOffset INTEGER (0..15),

dmrs-TypeA-Position ENUMERATED {pos2, pos3},

pdcch-ConfigSIB1 PDCCH-ConfigSIB1,

cellBarred ENUMERATED {barred, notBarred},

intraFreqReselection ENUMERATED {allowed, notAllowed},

spare BIT STRING (SIZE (1))

}

The information of systemFrameNumber, subCarrierSpacingCommon, ssb-SubcarrierOffset, dmrs-Type-Position, pdcch-ConfigSIB1 are used for the Uu transmission, thus no need to forward those information to remote UE. However, for cellBarred and intraFreqReselection, as they are related to access, further discussion is needed.

For the IDLE/INACTIVE relay UE, it is not allowed to camp on a barred cell, thus no need to discuss whether the field cellBarred should be forwarded. For the CONNECTED relay UE, the serving cell’s setting may be changed to barred after the UE established RRC connection. Then when the relay UE broadcasts discovery message to enable measurement for direct to indirect path switch, it should indicate the cell is barred in discovery message, otherwise the IDLE/INACTIVE remote UE may consider this relay UE as a suitable relay and (re)select it.

**Question 7: Do companies agree that cellBarred should be forwarded by CONNECTED relay UE via discovery message?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Xiaomi | No | We understand the cellBarred in MIB is introduced to prevent UE to camp on a cell which is used only for SCG. So, even CONNECTED relay UE would not connect to such cell as PCell. |
| Qualcomm | No | First, we think the issue scenario mentioned by Rapporteur is a corner case: “*For the CONNECTED relay UE, the serving cell’s setting may be changed to barred after the UE established RRC connection*”  Secondly, it can be achieved by gNB using RRCReject message instead. The system can also work. Because adding a new IE in discovery need to involve SA2 efforts, we prefer not to bother them. |
| Apple | No | If cell is barred, then the relay UE will stop announcing U2N relay service. Even if there are some connected remote UE when MIB changes, the relay UE can release all those remote UEs. |
| InterDigital | No | Agree with Apple. |
| OPPO | No | Agree with Qualcomm and Apple. |
| Intel | No | Agree with Qualcomm and Apple comments. |
| CATT | No | Agree with Apple, the relay UE should stop announcing U2N relay service when its serving cell is barred. And release the connected IDLE/INACTIVE remote UE. |
| MediaTek | No |  |
| CMCC | No |  |
| Sony | No |  |
| Nokia | No | It is corner case when a UE is connected to a barred cell. When the remote UE performs measurements, it will read the candidate cells' MIB and will discover that the cell is barred. |
| Sharp | No | Agree with Apple. |
| vivo | Yes | The cellBarred information forwarding is useful for remote UE to quickly perform relay reselection by skipping the barred cell. Since RAN2#116bis-e agreed that “Carry cellAccessRelatedInfo from SIB1 in discovery message using RRC container.”, RAN2 can directly include cellBarred also in the same RRC container which has no extra SA2 efforts. |
| Spreadtrum | No |  |
| Fujitsu | No |  |
| Ericsson | No |  |
| ZTE | No | If the serving cell is barred, the relay UE may refrain from relay discovery and does not accept new remote UE. This can be up to relay UE’s implementation. |

In Uu interface, when the cell is barred, the field intraFreqReselection indicates whether intra-freq cell reselection is allowed. In relay network, as the remote UE is not aware of the frequency of the relay UE’s serving cell, this field seems not useful.

**Question 8: Do companies agree that intraFreqReselection is not forwarded by relay UE?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Xiaomi | Yes | Agree with rapp |
| Qualcomm | Yes | We agree with Rapporteur. |
| Apple | Yes | Agree with the rapporteur |
| InterDigital | Yes |  |
| OPPO | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | Yes |  |
| Sony | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |

**3.3 Handling of *useT312***

During CR update, one issue was pointed out that whether the legacy *useT312* can be used for new measurement events X and Y introduced for relay.

The timer T312 was introduced to NR for fast failure recovery purpose in Rel-16. When *useT312* is set to true the UE shall use the timer T312 for the NR Meas Object. And the timer is started when a NR measurement report is triggered while the PCell is experiencing radio problem (T310 is running). One use case of T312 is that when the serving cell is about to RLF and the UE moves into a neighbour cell and triggers corresponding measurement report, the UE can immediately declare RLF instead of waiting for T310 expiry.

For event X1(Serving L2 U2N Relay UE becomes worse than threshold1 and NR Cell becomes better than threshold2) and X2 (Serving L2 U2N Relay UE becomes worse than threshold), the Remote UE is connected with a Relay UE, and should suspend Uu RLM, then T310 is not applicable as well as T312. Thus *useT312* should not be configured to event X1 and X2.

**Question 9: Do companies agree *useT312* cannot be configured to event X1 and X2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Xiaomi | Yes | T310 is not applicable |
| Qualcomm | Yes | We agree with Rapporteur. |
| Apple | Yes |  |
| InterDigital | Yes |  |
| OPPO | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | Yes |  |
| Sony | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |

Event Y1(PCell becomes worse than threshold1 and candidate L2 U2N Relay UE becomes better than threshold2) and Y2(Candidate L2 U2N Relay UE becomes better than threshold) are introduced for the UE connected via Uu interface but capable of L2 Remote UE to measure potential target Relay UE for direct-to-indirect path switch. In general, if the measurement reporting is triggered by a candidate Relay UE when T310 is running, the fast recovery mechanism via T312 might be still applicable. But considering *useT312* is not supported for inter-RAT measurement object in Rel-16, relay can be treated the same in this release to avoid any potential spec effort.

**Question 10: Do companies agree *useT312* cannot be configured to event Y1 and Y2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Xiaomi | Yes | Agree with rapp |
| Qualcomm | Yes | We agree with Rapporteur. |
| Apple | Yes |  |
| InterDigital | Yes |  |
| OPPO | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | Yes |  |
| Sony | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |

**3.4 Whether to include PCI in suspendConfig**

In previous meeting, it was agreed the C-RNTI and PCI of the serving cell should be configured to the remote UE via RRCSetup/RRCResume/RRCReestablishment/RRCReconfiguration(HO case), as the UE needs those information to set the content of RRCReestablishmentRequest for RRC reestablishment procedure. In last meeting, companies pointed out the C-RNTI should be included in suspendConfig in RRCRelease message. The reason is during RNAU with context relocation, the last serving cell is changed and the corresponding UE AS inactive context should be updated upon reception of RRCRelease message from the new last serving cell in legacy. Then for remote UE, the C-RNTI as well as PCI should be included in RRC message explicitly, as those information is to be used as input of calculation of ResumeMAC-I for the RRC resume procedure afterwards.

**Question 11: Do companies agree to include PCI in suspendConfig (together with C-RNTI)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Xiaomi | Yes |  |
| Qualcomm | Yes | We agree with Rapporteur. |
| Apple | Yes |  |
| InterDigital | Yes |  |
| OPPO | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | Yes |  |
| Sony | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |

**3.5 Whether SRAP configuration can be stored as UE Inactive AS context**

Below figure is to show a general configuration procedure for initial remote UE’s access. We can see the SRAP configuration will be provided together with Uu/PC5 RLC configuration to configure the remote UE ID and also the mapping between remote UE’s bearer and egress Uu/PC5 RLC.



In Rel-16, it was agreed that the SL configuration will be released upon the UE enters inactive stage, and captured in spec as “NOTE 2: NR sidelink communication related configurations and logged measurement configuration are not stored as UE Inactive AS Context, when UE enters RRC\_INACTIVE.” That means the PC5 RLC bearer configuration is released by relay UE and remote UE following the Rel-16 principle. Then as the SRAP is basically for bearer mapping, it does not make sense to maintain it when no PC5 RLC bearer to be mapped. No issue is foreseen to release the SRAP configuration as it can be configured after remote UE resumes the RRC connection afterwards.

Furthermore, if assuming the SRAP configuration is stored, RAN2 needs to discuss how to handle the configuration upon relay reselection, or relay UE’s RRC state change, which creates more work in RAN2. Thus the moderator suggests to clarify in spec that the SRAP configuration is not stored.

An example of the potential spec change to TS38.331 is below:

|  |
| --- |
| store in the UE Inactive AS Context the current KgNB and KRRCint keys, the ROHC state, the stored QoS flow to DRB mapping rules, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the NR PSCell (if configured) and all other parameters configured except for:  - parameters within *ReconfigurationWithSync* of the PCell;  - parameters within *ReconfigurationWithSync* of the NR PSCell, if configured;  - parameters within *MobilityControlInfoSCG* of the E-UTRA PSCell, if configured;  - *servingCellConfigCommonSIB*;  - parameters within *SL-SRAP-Config*, if configured; |

**Question 12: Do companies agree that SRAP configuration is not stored in UE Inactive AS context when relay UE/remote UE enters RRC\_INACTIVE?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Xiaomi | Yes | Agree with rapp. The SRAP configuration can be configured during RRC resume. |
| Qualcomm | Yes | We agree with Rapporteur. |
| Apple | Yes |  |
| InterDigital | Yes |  |
| OPPO | Yes |  |
| Intel | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
| CMCC | Yes |  |
| Sony | Yes |  |
| Nokia | Yes |  |
| Sharp | Yes |  |
| vivo | No | Since SRAP configuration is part of the Uu dedicated RRC configuration, it is natural that SRAP configuration can be stored as the UE Inactive AS context. The example with exceptional cases illustrated in above TS38.331 by the rapporteur is due to those configurations are PHY layer configurations and cannot be maintained. However, it is not the case for SRAP configuration because it’s L2 configurations and in fact can be maintained. We think It’s a bit contradictory that we don’t support SRAP configuration as the UE Inactive AS context while we support RRC\_INACTIVE for both Remote UE and Relay UE.  Moreover, for the “NOTE 2: NR sidelink communication related configurations and logged measurement configuration are not stored as UE Inactive AS Context, when UE enters RRC\_INACTIVE.”, it’s R16 SL principle and we may change it for R17 L2 relay. For example, we can simply clarify in the note that for L2 relay, the PC5 RLC bearer configuration is kept by relay UE and remote UE. |
| Spreadtrum | Yes |  |
| Fujitsu | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |

**3.6 Uu/PC5 RLC channel configuration [EN in RRC running CR and RAN3 LS R3-221411]**

The issue is how to configure RLC bearer in Uu hop and PC5 hop for remote UE and relay UE, i.e. using the existing RRC configuration or new introduced RRC configuration.

In legacy Uu interface, the Uu RLC bearer is configured via *RLC-BearerConfig* included in *CellGroupConfig*. The field of *servedRadioBearer* provides the association between the RLC bearer and an SRB/DRB, which needs to be present upon creation of a new logical channel according to the condition explanation of *LCH-SetupOnly*.

RLC-BearerConfig ::= SEQUENCE {

logicalChannelIdentity LogicalChannelIdentity,

servedRadioBearer CHOICE {

srb-Identity SRB-Identity,

drb-Identity DRB-Identity

} OPTIONAL, -- Cond LCH-SetupOnly

reestablishRLC ENUMERATED {true} OPTIONAL, -- Need N

rlc-Config RLC-Config OPTIONAL, -- Cond LCH-Setup

mac-LogicalChannelConfig LogicalChannelConfig OPTIONAL, -- Cond LCH-Setup

...,

[[

rlc-Config-v1610 RLC-Config-v1610 OPTIONAL -- Need R

]]

}

|  |  |
| --- | --- |
| *LCH-SetupOnly* | This field is mandatory present upon creation of a new logical channel. It is absent, Need M otherwise. |

Similar situation exists for PC5 RLC bearer configuration. As specified in Rel-16 for NR V2X, SL RLC bearer is configured via *SL-RLC-BearerConfig* included in *SL-PHY-MAC-RLC-Config* (within *SL-ConfigDedicatedNR*). The field of *sl-ServedRadioBearer* gives the association of sidelink RLC bearer with a sidelink DRB, which is mandatory present upon creation of a new sidelink logical channel according to the condition explanation of *LCH-SetupOnly*.

SL-RLC-BearerConfig-r16 ::= SEQUENCE {

sl-RLC-BearerConfigIndex-r16 L-RLC-BearerConfigIndex-r16,

sl-ServedRadioBearer-r16 SLRB-Uu-ConfigIndex-r16 OPTIONAL, -- Cond LCH-SetupOnly

sl-RLC-Config-r16 SL-RLC-Config-r16 OPTIONAL, -- Cond LCH-Setup

sl-MAC-LogicalChannelConfig-r16 SL-LogicalChannelConfig-r16 OPTIONAL, -- Cond LCH-Setup

...

}

|  |  |
| --- | --- |
| *LCH-SetupOnly* | This field is mandatory present upon creation of a new sidelink logical channel via the dedicated signalling and in case of sidelink DRB configuration via system information and pre-configuration. Otherwise, it is absent, Need M. |

Due to above, **reusing existing RLC-BearerConfig** to configure Uu RLC bearer to a Relay UE for the relay specific traffic (Note it was agreed that relay traffic and non-relay traffic will use separate Uu LC ID.) needs to consider how to handle the existing field of *servedRadioBearer*.

* One way is to update the condition explanation, i.e. “This field is mandatory present upon creation of a new logical channel for a configured SRB or DRB. It is absent, Need M otherwise.”.
* Another way is to clarify that a L2 U2N Relay UE will ignore this field.

Another option is **introducing a new Uu RLC bearer configuration**, like for IAB BH channel. This may lead to a UE capability discussion, i.e. aside of legacy LCID number, how many Uu RLC bearers can be supported for relaying service.

Meanwhile, the very similar issue was discussed in RAN3 #114bis-e meeting, i.e. how to configure the Uu RLC channel for relay UE in CU-DU split architecture. There are two options as blow. Option1 is to update RAN3 F1 interface which allows RAN2 spec to reuse the existing RLC-bearerConfig; while the Option2 is to update RAN2 RRC spec which allows RAN3 to reuse the existing F1AP produces. The majority view is both ways work, but in order to push the progress the LS R3-221411 is sent to RAN2.

|  |
| --- |
| * + Option 1: follow RAN2 signaling design and enhance RAN3 spec.   + Option 2: send LS to RAN2 and ask RAN2 update their spec. |

The main difference between the two options is option 1 is touching only CU-DU interface, but option2 touches both relay UE/remote UE and RAN.

Therefore RAN2 needs to decide whether existing Uu bearer configuration or new RLC bearer configuration is to be used and send the reply to RAN3. The same solution selected for Uu RLC bearer configuration should be applied to PC5 RLC configuration as well.

**Question 13: To configure Uu RLC bearer for relaying service, which option is preferred:**

* **Option 1: reusing existing *SL-RLC-BearerConfig*, by handling the *servedRadioBearer* as**
  + **1a: modifying the condition as NW will only configure the field to a configured SRB or DRB i.e. non-relaying RLC channel.**
  + **1b: L2 U2N Relay UE ignoring the field.**
* **Option 2: introducing new RLC configuration.**

|  |  |  |
| --- | --- | --- |
| Company | Option 1a/1b/2 | Comments |
| Xiaomi | 1a | We think 1a is enough. |
| Qualcomm | Option 2 | 1. As Rapporteur analysed, it will incur multiple issues if we reuse legacy IE *SL-RLC-BearerConfig.* So, we don’t prefer Option 1 because it may cause legacy impacts/issues. 2. Meanwhile, for the RAN3 raised issue, we prefer to use RLC channel ID, i.e., update RAN2 RRC spec which allows RAN3 to reuse the existing F1AP produces. Because we understand RAN3 impact on existing F1AP procedure is large, but RRC spec is not frozen yet.   Based on above two justifications, we prefer to introduce a new RLC configuration dedicated to L2 relay, which is a cleaner way. |
| Apple | Optoion 2 | Agree with Qualcomm |
| InterDigital | Option 2 | Agree with QC |
| OPPO | Option 2 |  |
| Intel | Option 2 |  |
| CATT | Option 2 | Agree with Qualcomm |
| MediaTek | Option 2 |  |
| CMCC | Option 2 |  |
| Sony | Option 2 |  |
| Nokia | Option 1a |  |
| Sharp | Option 2 |  |
| vivo | Option 2 | It’s preferred not to use legacy LCID for the F1AP signaling. Just like IAB, we can introduce new RLC channel configuration for relaying purpose. |
| Spreadtrum | Option 2 |  |
| Fujitsu | Option 2 |  |
| Ericsson | Option 1a | We think that a small addition to the conditional presence would be enough. However the suggested formulation is also quite ambiguous and a discussion is needed on how exactly to capture this. |
| ZTE | Option 2 | Option 2 is more clear. The new RLC configuration can be designed based on what is really needed. |

**3.7 FFS on the configuration of LCID for PC5 RLC channel of Uu SRB1, SRB2 and DRBs.**

This is to address the following left issue from pre-116b summary. i.e. Proposal 11 (low priority) Regarding how to allocate LCID for PC5 RLC channel of remote UE Uu RBs including SRB2 and DRBs, RAN2 to down select the following options. FFS on SRB1

a. Option 1: allocated by UE same as in R16 SL

b. Option 2: up to gNB dedicated configuration same as in Uu

**Question 14: Which option is preferred between option1 and option2?**

|  |  |  |
| --- | --- | --- |
| Company | Option1/ Option2 | Comments |
| Xiaomi | 1 | Option 2 may result in LCID collision between remote UE and relay UE, since gNB is not aware of the LCID which has already been used by remote UE. |
| Qualcomm | Option 1 | 1. Option 1 can reduce spec impact compared to Rel-16 SL   In L2 relay, we have agreed that remote UE can only use mode-2 RA. Because remote UE’s measurements may not be always be available to gNB and relay UE knows the quick change of remote UE’s channel/traffic status, we prefer relay UE to allocate LCID based on dynamic status of remote UE. |
| Apple | Option 1 |  |
| InterDigital | Option 1 |  |
| OPPO | Option 1 |  |
| Intel | Option 1 |  |
| CATT | Option 1 |  |
| MediaTek | Option 1 |  |
| CMCC | Option 1 |  |
| Sony | Option 1 |  |
| Nokia | Option 1 |  |
| Sharp | Option 1 |  |
| vivo | Option 2 | For L2 remote UE, it will establish Uu E2E RRC connection with the gNB. We think it’s more reasonable to follow Option 2. Moreover, Option 2 can avoid the R16 SL RLC mode mismatch issue in Option 1 (see below).  NOTE 1: When the same logical channel is configured with different RLC mode by another UE, the UE handles the case as sidelink RRC reconfiguration failure. |
| Spreadtrum | Option 1 |  |
| Fujitsu | Option 2 | We prefer that the gNB configures the LCID to both the remote UE and the relay UE. |
| Ericsson | Option 1 |  |
| ZTE | Option 2 | The LCID is generally unique within one source and destination UE pair. For the remote UE connected to the network via relay UE, the serving cell of remote UE is the same as relay UE. gNB may allocate the same LCID for a given PC5 RLC channel between relay UE and remote UE. There is no LCID collisions.  On the other hand, as we agreed before, remote/relay UE is not allowed to report the PC5 QoS information parameter to gNB. gNB anyway need to send the PC5 RLC channel configuration to relay UE and remote UE respectively based on the remote UE’s E2E bearer QoS. For this scenario, the benefit for the UE allocated LCID is not clear and it needs further check how to enable the bi-directional PC5 RLC channel configuration. |

# 3 Conclusion

# 4 References