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

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# 3 Discussion

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

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| **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?**

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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.

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|  | 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?**

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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?**

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**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?**

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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?**

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**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?**

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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?**

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| Company | Answer (One or more solutions among solution 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 4) |
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**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?**

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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?**

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**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?**

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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?**

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**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)?**

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**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:

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| 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?**

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**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

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[[

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

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}

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| *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

...

}

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| *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.

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| * + 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.**

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**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?**

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| Company | Option1/ Option2 | Comments |
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# 3 Conclusion

# 4 References