**3GPP TSG-RAN WG2 Meeting #114 e R2-21xxxxx**

**E-Meeting, 19th - 27th May 2021**

**Source: vivo (Rapporteur)**

**Title:****Summary on agenda item 8.7.4.1 on L2 relay control plane**

**Agenda Item:** **8.7.4.1**

**Document for:** **Discussion and Decision**

# Introduction

A Pre-meeting offline discussion was triggered as follows:

* [Pre114-e][604][Relay] Summary on agenda item 8.7.4.1 on L2 relay control plane (vivo)

The offline discussion was summarized in [1] with the following proposals

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| --- |
| **[Easy]**  **Proposal 1： [Easy] RAN2 to confirm that the RRC state combination of Relay UE in RRC\_IDLE and Remote UE in RRC\_INACTIVE is supported.**  **Proposal 6： [Easy] The indication of Relay UE upon detecting Uu RLF may trigger the Remote UE connection re-establishment.**  **Proposal 7： [Easy] Remote UE may trigger the Remote UE connection re-establishment upon detecting PC5 RLF.**  **Proposal 10： [Easy] For IC case, Remote UE performs TAU/RNAU based on its own serving cell information (i.e., as legacy) if Remote UE is NOT PC5-connected with Relay** UE.  **Proposal 20： [Easy] When a Relay UE in RRC IDLE or RRC INACTVE, the Relay UE monitors paging occasions of its PC5-RRC connected Remote UEs.**  **[Cross WG]**  **Proposal 2： [Cross WG] RAN2 to decide firstly whether new or existing establishment/resume cause value is used for Relay UE when Relay UE enters RRC\_CONNECTED only for relaying purpose.**  **Proposal 3： [Cross WG] Send LS to SA2/CT1 to check their view on whether new or existing establishment/resume cause value is** used.  **Proposal 12： [Cross WG] In case of remote UE RRC resume, RAN2 to discuss when the Retrieve UE Context procedure is performed, the new gNB may retrieve both the** remote and relay UE context.  **Proposal 13： [Cross WG] If it is agreed that when the Retrieve UE Context procedure is performed, the new gNB may retrieve both the remote and relay UE context, RAN2 to send a Ls to RAN3 on whether UE Context has inter-gNB specification impact**  **Proposal 27： [Cross WG] Confirm the WA that Remote UE performs UAC based on legacy procedure independently.**  **Proposal 28： [Cross WG] RAN2 to discussion whether Relay UE should perform UAC or can skip UAC when it intends to access network only for the purpose of relaying but not for its own service.**  **Proposal 29： [Cross WG] Send a LS to SA2 to ask SA2 view on whether Relay UE should perform UAC or can skip UAC when it intends to access network only for the purpose of relaying but not for its own** service  **[For discussion]**  **Proposal 4： [For discussion] For the delivery of remote UE’s SRB0 RRC message, for the configuration of Uu RLC channel the following options can be considered**   * + - * + **Default configuration**         + **Specified (fixed) configuration**         + **Network configurable**   **Proposal 5： [For discussion] For the delivery of Remote UE’s SRB1 RRC message such as *RRCResume* and *RRCReestablishment* message as legacy SRB1:**   * + - Introduce default configuration of Uu RLC channel for relaying, which can be reconfigured to dedicated signalling by the Network     - Network configuration via dedicated signaling is used for the configuration of Uu RLC channel if available in Relay UE. Otherwise, default configuration is used   **Proposal 8： [For discussion] The Remote UE performs RRC re-establishment procedure as follows:**   * If a suitable cell is available, the Remote UE initiates RRC re-establishment procedure towards the suitable cell; * If a suitable relay is available, the Remote UE initiates RRC re-establishment procedure towards the suitable relay UE’s serving cell; * If both a suitable cell and a suitable relay are available, the remote UE can select either one to initiate RRC re-establishment procedure based on implementation.   **Proposal 9： [For discussion] For OOC case, RAN2 to discuss whether Remote UE should perform TAU/RNAU procedure.**  **Proposal 11： [For discussion] For IC case, Remote UE performs TAU/RNAU based on Relay UE’s serving cell information after Remote UE is PC5-connected with Relay UE.**  **Proposal 14： [For discussion] The serving gNB of the Relay UE allocates Remote UE ID to be used in adaptation layer. FFS details.**  **Proposal 15： [For discussion] Remote UE can receive the system information via PC5 before and after PC5 connection establishment with Relay UE.**  **Proposal 16： [For discussion] RAN2 to decide whether minimum SI or essential SIB(s) should be defined for Remote UE.**  **Proposal 17： [For discussion] If minimum SI or essential SIB(s) is supported, whether the minimum SI or essential SIB(s) should be defined before or after the remote UE PC5 connection establishment with Relay UE**  **Proposal 21： [For discussion] When Relay UE in RRC CONNECTED and Remote UE in RRC\_IDLE/RRC\_INACTIVE, whether the Relay UE monitors PO of its PC5-RRC connected Remote UE(s) or receive paging message of the Remote UE(s**) through dedicated RRC message.  **Proposal 22： [For discussion] When Relay UE in RRC CONNECTED and remote UE in RRC CONNECTED, Relay UE may monitor only for SI change indication and/or PWS notifications in any PO.**  **Proposal 24： [For discussion] RAN2 to decide whether Short Paging message forwarding over sidelink is supported in Rel-17.**  **[Lower priority**]  **Proposal 18： [Lower priority] RAN2 to discuss how SIB(s) can be forwarded after decision on if minimum SI or essential SIB(s) is defined for Remote UE.**  **Proposal 19： [Lower priority] For IC, RAN2 to discuss whether Remote UE shall be allowed to request and receive SI over direct (Uu) path. FFS on any enhancement to Remote UE if both direct (Uu) path and indirect (relay) path are available for SI request and reception.**  **Proposal 23： [Lower priority] RAN2 to discuss whether Relay UE can skip Paging monitoring of Remote UEs after the baseline paging monitoring and forwarding mechanism is clear.**  **Proposal 25： [Lower priority] RAN2 to study if any potential issue and solution needed on Remote UE and Relay UE PO overlapping case**.  **Proposal 26： [Lower priority] A new PC5-RRC message is needed to relay the paging information from relay UE to Remote UE for unicast.** |

The following offline discussion is further triggered to mainly discuss these proposals as follows:

* [AT114-e][604][Relay] Summary on agenda item 8.7.4.1 on L2 relay control plane (vivo)

Scope: Discuss the proposals in R2-2106463 and progress toward consensus where possible.

Intended outcome: Report to comeback session

**Deadline: 2021-05-25 1000 UTC**

The Rapporteur proposes to conduct this email discussion as follows:

* **Phase 1**: Companies provide feedback on the questionnaire of this email discussion by **2021-05-21 1000 UTC**
* **Phase 2**: Rapporteur submit a summary and proposals based on the feedback and companies can comments on the summary and proposals by **2021-05-25 0700 UTC, to allow time for final proposals reshaping and Tdoc submission.**

# Discussion

## Connection management

On RRC state combination of relay UE and remote UE an open issue in the offline #603 at last RAN2#113bis-e meeting.

*Proposal 7: [16/21] [For discussion] The RRC state combination of relay in IDLE and remote UE in INACTIVE is supported.*

During summary of contributions proposed at this meeting, it is observed that the majority companies still would like to confirm the support of RRC state combination of Relay UE in RRC\_DLE and Remote UE in RRC\_INACTIVE. The following proposal was captured in [1]:

***Proposal 1： [Easy] RAN2 to confirm that the RRC state combination of Relay UE in RRC\_IDLE and Remote UE in RRC\_INACTIVE is supported.***

As such RRC state combination has been discussed since SI phase for several times and should be determined ASAP, as rapporteur we suggest RAN2 to confirm the support of RRC state combination of Relay UE in RRC\_DLE and Remote UE in RRC\_INACTIVE. The potential specification impact to support such RRC state combination can be investigated later based on company contributions in future meetings if any.

**Q1: Do companies agree that the RRC state combination of Relay UE in RRC\_IDLE and Remote UE in RRC\_INACTIVE is supported?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | We think the only RAN2 impact to allow it is that IDLE relay UE will be allowed to receive RAN paging of Remote UE. This is a small spec impact.  On the other hand, if we don’t allow this state combination, we need to specify procedure to preclude it, which is similar to what we specified for remote UE RRC establishment in section 4.5.5.1 of TR 38.836 (i.e. *If the Relay UE had not started in RRC\_CONNECTED, it would need to do its own connection establishment upon reception of a message on the default L2 configuration on PC5*). It will imply much more RAN2 specification work.  Considering RRC state is NW decision, we prefer to allow this state combination in spec, so that whether to have it can left for NW implementation (i.e. avoid spec work in RAN2). |
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**Summary:**

On cause value of relay UE establishment/resume, the following proposal is left as an open issue in the offline #603 at last RAN2#113bis-e meeting as.

*Proposal 1: [16/23, 22/23] [Cross group] New establishment/resume cause value should be set when relay UE enters RRC\_CONNECTED for relaying purpose. RAN2 send an LS to SA2/CT1 on RAN2’s progress on this.*

According to proposals submitted at this meeting on cause value for relay UE [1], there is no clear majority view on this issue on whether existing cause value should be used or a new cause value should be introduced. And the following proposal was summarized:

***Proposal 2： [Cross WG] RAN2 to decide firstly whether new or existing establishment/resume cause value is used for Relay UE when Relay UE enters RRC\_CONNECTED only for relaying purpose.***

***Proposal 3： [Cross WG] Send LS to SA2/CT1 to check their view on whether new or existing establishment/resume cause value is*** *used.*

Regardless of on whether existing cause value should be used or a new cause value should be introduced, RAN2 need to involve other WG such SA2/CT1, therefore Rapporteur thinks there is two approaches on RAN2 how can further progress on this issue:

* RAN2 made a clear decision and inform SA2/CT1 to investigate their corresponding specification impact.
* RAN2 does not make clear decision and directly ask SA2/CT1 their view on whether existing cause value should be used or a new cause value should be introduced.

Therefore, Rapporteur proposes:

**Q2-1: Which establishment/resume cause value is used for Relay UE when Relay UE enters RRC\_CONNECTED only for relaying purpose?**

* **Option 1: new establishment/resume cause value;**
* **Option 2: existing establishment/resume cause value.**

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| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| Qualcomm | Option 1 if UAC in relay is agreed to skip; otherwise option 2 | We think this issue is coupled with whether UAC is required in relay UE.   1. Assuming we do only UAC for remote UE, we think a new single establishment cause is more reasonable because we are not sure how NW can do better with cause value from relay. Our understanding of the procedure is: gNB always allows relay UE connection and gets real cause value after reception of remote UE’s RRC Setup/Resume request later. Then, based on the real cause value, gNB can make RRC Reject decision for relay UE if needed. We think it is the solution with smallest spec impact. To align cause value between relay and remote requires either PC5 signaling change or procedure change 2. If we also do UAC for relay UE, we see some benefit for relay UE to align cause value with remote UE, so that NW can do a better decision on whether to reject relay’s connection request. However, we don’t prefer relay UE to perform UAC. |
|  |  |  |

**Q2-2: Do companies agree to send a LS to SA2/CT1 to either inform them about RAN2 decision or to ask their view on whether a new or existing establishment/resume cause value is used?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree |  |
|  |  |  |

**Summary:**

On SRB0/SRB1, there are still 2 FFS points in the following agreement for Uu RLC channel of Remote UE’s SRB0 and SRB1.

Agreement：

Proposal 6-1: [20/23] [Easy] For the delivery of remote UE’s SRB0 RRC message, specified (fixed) configuration is used for the configuration of PC5 RLC channel. FFS for the Uu RLC channel.

Proposal 6-2: [21/23, 22/23] [Easy] For the delivery of remote UE’s SRB1 RRC message other than RRCResume and RRCReestablishment message, network configuration via dedicated signalling is used for the configuration of PC5 RLC channel and Uu RLC channel.

Proposal 6-3: [23/23] [Easy] For the delivery of remote UE’s SRB1 RRC message such as RRCResume and RRCReestablishment message, default configuration is used for the configuration of PC5 RLC channel which can be reconfigured by network. FFS for Uu RLC channel.

A couple of companies have submitted contributions with proposals addressing those 2 FFS. Based on proposals captured in [1], it is observed that:

* For the delivery of Remote UE’s SRB0 RRC message, three approaches can be observed:
  + Default configuration
  + Specified (fixed) configuration
  + Network configuration
* For the delivery of Remote UE’s SRB1 RRC message such as *RRCResume* and *RRCReestablishment* message two approaches can be observed:
  + Default configuration
  + Network configuration

And the following proposals were summarized [1]:

***Proposal 4： [For discussion] For the delivery of remote UE’s SRB0 RRC message, for the configuration of Uu RLC channel the following options can be considered***

* + - * + ***Default configuration***
        + ***Specified (fixed) configuration***
        + ***Network configurable***

***Proposal 5： [For discussion] For the delivery of Remote UE’s SRB1 RRC message such as RRCResume and RRCReestablishment message as legacy SRB1:***

* + - *Introduce default configuration of Uu RLC channel for relaying, which can be reconfigured to dedicated signalling by the Network*
    - *Network configuration via dedicated signaling is used for the configuration of Uu RLC channel if available in Relay UE. Otherwise, default configuration is used*

For both the delivery of Remote UE’s SRB0 and SRB1,there is no clear majority on which configuration to used. To make progress Rapporteur would like to invite companies to think about the potential use cases for *RRCResume* and *RRCReestablishment*:

* **Case 1:** Remote UE Resume or Reestablishment to its own serving cell
* **Case 2:** Remote UE Resume or Reestablishment via current Relay UE to Relay UE’s serving cell
* **Case 3:** Remote UE Resume or Reestablishment via new Relay UE to Relay UE’s serving cell

If RAN2 aims to achieve common solution for the above 3 use case for *RRCResume* and *RRCReestablishment*, then for the delivery of remote UE’s SRB0 RRC message, specified (fixed) configuration can be used for the configuration of Uu RLC channel as legacy SRB0. And for delivery of Remote UE’s SRB1 RRC message such as *RRCResume* and *RRCReestablishment* message, default configuration can be at least used for the configuration of Uu RLC channel as legacy SRB1, which can be reconfigured by the network later in *RRCResume* message and first *RRCReconfiguration* message after *RRCReestablishment*. Therefore,

**Q3-1: For the delivery of remote UE’s SRB0 RRC message, which option(s) is chosen for the configuration of Uu RLC channel?**

* **Option 1: Default configuration**
* **Option 2: Specified (fixed) configuration**
* **Option 3: Network configurable**
* **Option 4: others, please specify**

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| **Company** | **Option(s)** | **Comment** |
| Qualcomm | Option 1 and Option 3 (i.e. NW configuration is used if available in Relay UE. Otherwise, default configuration is used) | Uu RLC config has one big difference from PC5 RLC config: Uu RLC is only used by relay UE in CONNECTED state while PC5 RLC is also used by remote UE in IDLE/INACTIVE state. So, we think we can have different solutions from PC5 RLC.  As analyzed in our contribution, it is also different from legacy Uu RRC procedure because **gNB is not aware of remote UE at this timing point because remote UE is in IDLE/INACTIVE state**. Therefore, although relay UE is in CONNECTED state, the remote UE’s dedicated Uu RLC channel for relaying is not configured yet. There are two alternatives to resolve this issue:  ‘ Alt-1 (default config which can be reconfigured + NW config)  Alt-2 (Always wait for NW configuration)  We think Alt-1 has the benefit to reduce latency by saving 2 RRC messages with the cost of reserving a LCID. And the cons of Alt-1 (i.e. reservation of LCID) should not a big issue because default Uu RLC channel can be reused by different remote UEs and we can also use eLCID. |
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**Q3-2: Do companies agree that the delivery of Remote UE’s SRB1 RRC message such as *RRCResume* and *RRCReestablishment* message can reuse the same rule of legacy SRB1, i.e.?**

* **Introduce default configuration of Uu RLC channel for relaying, which can be reconfigured to dedicated signalling by the Network**
* **Network configuration via dedicated signaling is used for the configuration of Uu RLC channel if available in Relay UE. Otherwise, default configuration is used**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | Because relay UE is CONNECTED state, we think Uu RLC handling is same for SRB0 and SRB1 (*RRCReestablishment / RRCResume*). So, we prefer to use a common solution for them. It means we can only specify one common reserved LCID for both SRB0 and SRB1 (*RRCReestablishment / RRCResume*) |
|  |  |  |

**Summary:**

On RRC There are still 2 FFS points in the following agreement related to PC5 RLF and Uu RLF.

Agreement:

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

Agreement:

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

Although the above agreement was discussed and reached in the AI of 8.7.3 Relay re/selection, but, they may have some impact to the RRC re-establishment procedure of Remote UE. Based on contributions submitted, the impact to RRC re-establishment may be related to:

* Uu RLF detected by Relay UE
* PC5 RLF detected by Remote UE
* Remote UE re-establishes towards a suitable cell or suitable relay UE

And the following proposals were summarized:

***Proposal 6： [Easy] The indication of Relay UE upon detecting Uu RLF may trigger the Remote UE connection re-establishment.***

***Proposal 7： [Easy] Remote UE may trigger the Remote UE connection re-establishment upon detecting PC5 RLF.***

***Proposal 8： [For discussion] The Remote UE performs RRC re-establishment procedure as follows:***

* *If a suitable cell is available, the Remote UE initiates RRC re-establishment procedure towards the suitable cell;*
* *If a suitable relay is available, the Remote UE initiates RRC re-establishment procedure towards the suitable relay UE’s serving cell;*
* If both a suitable cell and a suitable relay are available, the remote UE can select either one to initiate RRC re-establishment procedure based on implementation.

In case that the Relay UE Uu RLF, majority companies think that this situation can be indicated to Remote UE instead of using existing PC5-S message (i.e., PC5 link release similar to LTE).

But details of the indication/message e.g., PC5 RRC or adaptation layer control PDU may need further study. Moreover, the Remote may treat it as end-to-end radio link failure based on the indication and trigger re-establishment. Therefore,

**Q4-1: Do companies agree that the indication of Relay UE upon detecting Uu RLF may trigger the Remote UE connection re-establishment?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | We think either PC5 RLF or Uu RLF can be regarded as failure of “End-to-End link failure” of remote UE. |
|  |  |  |

In case of the PC5 RLF detected by Remote UE itself, the Remote may also treat it as end-to-end radio link failure and trigger re-establishment. Thus, similar to Uu RLF we have:

**Q4-2: Do companies agree that Remote UE may trigger the Remote UE connection re-establishment upon detecting PC5 RLF?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | We think either PC5 RLF or Uu RLF can be regarded as failure of “End-to-End link failure” of remote UE. |
|  |  |  |

Since Remote UE performs relay (re)selection and cell (re)selection independently. The suitable cell condition and/or suitable relay condition may be fulfilled when the Remote UE initiates the RRC re-establishment procedure. It is not clear for now that Remote UE re-establishes towards a suitable cell or suitable relay UE when either or both conditions are met. To simplify the Remote UE behaviour, rapporteur suggest the following methods can be considered as baseline.

The Remote UE may perform RRC re-establishment procedure as follows:

* If a suitable cell is available, the Remote UE initiates RRC re-establishment procedure towards the suitable cell;
* If a suitable relay is available, the Remote UE initiates RRC re-establishment procedure towards the suitable relay UE’s serving cell;
* If both a suitable cell and a suitable relay are available, the remote UE can select either one to initiate RRC re-establishment procedure based on implementation.

Therefore, companies are invited to feedback on the following question:

**Q4-3: Does company agree the Remote UE may perform RRC re-establishment procedure as follows?**

* **If a suitable cell is available, the Remote UE initiates RRC re-establishment procedure towards the suitable cell;**
* **If a suitable relay is available, the Remote UE initiates RRC re-establishment procedure towards the suitable relay UE’s serving cell;**
* **If both a suitable cell and a suitable relay are available, the remote UE can select either one to initiate RRC re-establishment procedure based on implementation.**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comments** |
| Qualcomm | Agree | We think it is the consequence if we follow agreements made in last meeting:  Proposal 8: If both a suitable cell and a suitable relay are available, the remote UE can select either one (or both, for L3 relay only) based on its implementation in this release (i.e. TS 38.304 will not specify any additional procedure for selecting between the cell and the relay). FFS whether any enhancements to the cell (re)selection procedure for L2 relay.  Whether to configure a priority to re-establish via relay or gNB can be discussed further |
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**Summary:**

With regard to Remote UE TAU and RNAU, RAN2 made the following agreement.

Agreement：

Proposal 5: [23/23] [Cross group] [Easy] The remote UE should perform TAU/RNAU procedure while in RRC\_INACTIVE and RRC\_IDLE. No LS to be sent from this meeting to SA2/ CT1/RAN3 on the remote UE’s TAU/RNAU procedure.

For OOC case, whether the OOC Remote UE should perform TAU/RNAU procedure or not needs to be clarified. With regard to this OOC Remote UE case, there was proposals to address whether Remote should perform TAU/RNAU. companies’ proposals view differ on this issue. And the summary captured the following proposals:

***Proposal 9： [For discussion] For OOC case, RAN2 to discuss whether Remote UE should perform TAU/RNAU procedure.***

Companies are invited to address the above proposal in the following question:

**Q5: Do companies agree that for OOC case, Remote UE should perform TAU/RNAU procedure?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Yes | We think legacy TAU/RNAU procedure can work for OOC remote UE without spec change. We think relay can send its serving cell’s TAI and RAN area ID to the Remote UE. It can be signalled via SIB forwarding or dedicated PC5-RRC. Then, based on them, OOC remote UE performs TAU/RNAU procedure |
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**Summary:**

For IC remote UE case, regarding how to judge the Remote UE moves out of its configured TA/RNA, two different cases can be considered.

* Case 1: Remote UE is NOT PC5-connected with Relay UE;
* Case 2: Remote UE is PC5 connected with Relay UE.

For Case 1, it is clear that Remote UE performs TAU/RNAU as legacy, i.e., read SIB1 from its own serving cell to decide the trigger of TAU/RNAU. While for Case 2, Remote UE is controlled by the Relay UE's serving cell. Several companies suggested that Remote UE performs TAU/RNAU based on Relay UE’s serving cell in such case. However, there are also some companies which would like to enhance Relay UE’s TAU/RNAU procedure on behalf of Remote UE. Thus, the following two proposals were capture in the summary:

***Proposal 10： [Easy] For IC case, Remote UE performs TAU/RNAU based on its own serving cell information (i.e., as legacy) if Remote UE is NOT PC5-connected with Relay*** *UE.*

***Proposal 11： [For discussion] For IC case, Remote UE performs TAU/RNAU based on Relay UE’s serving cell information after Remote UE is PC5-connected with Relay UE.***

Companies are invited to address the above two proposals in the following questions:

**Q6-1: Do companies agree that for IC Remote UE case, Remote UE performs TAU/RNAU based on its own serving cell information (i.e., as legacy) if it is NOT PC5-connected with Relay UE?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | It is legacy procedure. We don’t see reason to change it |
|  |  |  |

**Q6-2: Do companies agree for IC Remote UE case, Remote UE performs TAU/RNAU based on Relay UE’s serving cell information after it is PC5-connected with Relay UE?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | We prefer a unified procedure for OOC remote UE, as indicated in Q5. Here, the serving cell information is serving cell’s TAI and RAN area ID. |
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**Summary:**

In case the Relay perform HO to another gNB, RAN2#113-bisRAN2 has made the following agreement

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

There some considerations of remaining issue related to this agreement open issue “FFS other indication/message can also be used” in term of:

* Retrieval of a remote UE’s context to a new gNB
* Indicates to the new gNB that the UE context of both the remote UE and relay UE should be retrieved

One can argue that gNB may keep UE context for the remote UE and another gNB for the relay UE, in that case during the Retrieve UE Context procedure, the UE context of the remote UE and relay UE may be retrieved towards different gNBs. In order the UE context of both the remote UE and relay UE to be retrieved, the new gNB should be aware that there is a relay connection on-going. As if the new gNB may retrieve both the remote and relay UE context, this case may involve some Cross WG works, thus, the summary capture two proposals as follows:

***Proposal 12： [Cross WG] In case of remote UE RRC resume, RAN2 to discuss when the Retrieve UE Context procedure is performed, the new gNB may retrieve both the*** *remote and relay UE context.*

***Proposal 13： [Cross WG] If it is agreed that when the Retrieve UE Context procedure is performed, the new gNB may retrieve both the remote and relay UE context, RAN2 to send a Ls to RAN3 on whether UE Context has inter-gNB specification impact***

Rapporteur is skeptical whether agreeing to above proposals may require further Inter-gNB works that may not be in the scope of this WI. thus, companies are invited to address the above two proposals in the following questions:

**Q7-1: Do companies agree that in case of Remote UE RRC resume to a new gNB, when the Retrieve UE Context procedure is performed, the new gNB may retrieve both the Remote and Relay UE context?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Disagree | First, we think the independent handling of UE context from remote UE and relay UE can work, i.e. if remote UE performs resume, target gNB only retrieves UE context of remote UE; if relay UE performs resume, target gNB only retrieves UE context of relay UE. Such solution will not require any spec impact in RAN3.  Then, we regard the proposed solution as an optimization to reduce inter-node signaling, and it will incur spec impact in RAN3. In addition, such optimization is a kind of group mobility, which is out of scoping. Thus, we don’t think it is an essential optimization to pursue in this release. |
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**Q7-2: If the ANS to Q7-1 is Agree, do companies agree to send a LS to RAN3 on whether UE Context has inter-gNB specification impact?**

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| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
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**Summary:**

With regard to Remote UE IDRAN2 has agreed that the UE ID in adaptation layer header is local temporary ID. But, which node, relay UE or Remote UE serving gNB, assign the local UE ID tis FFS as shown below:

Agreements:

Proposal 3b: The UE ID in the adaptation layer header is a local, temporary remote UE ID. FFS whether the local, temporary remote UE ID is assigned by the relay UE, or the serving gNB of the relay UE. (23/24)

There are many companies addressing this FFS. Based on proposals on this FFS, there is slightly more companies who prefer the network controlled Remote UE ID allocation. This is also in line with legacy Uu that all radio protocol layer configuration is under the network control. Therefore, rapporteur suggested that we take one step further to make one choice based on above agreement. Thus, the summary captures the following proposal:

***Proposal 14： [For discussion] The serving gNB of the Relay UE allocates Remote UE ID to be used in adaptation layer. FFS details.***

As decision on which node allocate the remote UE temporary ID may require sending ls to SA3, Rapporteur suggests companies to strive for an agreement at this meeting by addressing the following question:

**Q8: Do companies agree that the serving gNB of the Relay UE allocates Remote UE ID to be used in adaptation layer?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Disagree | We think it will be simpler if remote UE to allocate and update temporary ID, as illustrated in below Figure:    We see some companies argue that relay UE may not allocate non-overlapping temp remote UE ID. However, we don’t think it is an issue because gNB just needs to maintain a mapping from (relay UE ID, temp remote UE ID) to remote UE’s GUTI, i.e. no need to have 1:1 mapping between temp remote UE ID and its GUTI in gNB |
|  |  |  |

**Summary:**

## SIB delivery

With regard to whether the SI can be delivered to remote UE before vs after PC5 connection, the ollowing proposals are left as open issues due to lack of online time for discussion:

*Proposal 10-1: [18/23] Remote UE can receive the system information via PC5 both before and after PC5 connection establishment with relay UE.*

*Proposal 10-3: [20/23] [Easy] If remote UE can receive the system information via PC5 before PC5 connection establishment with relay UE, broadcast can be used for the system information forwarding via PC5.*

*Proposal 10-4: [22/23] [Easy] If remote UE can receive the system information via PC5 after PC5 connection establishment with relay UE, at least unicast can be used for the system information forwarding via PC5.*

Companies have further considered those proposals with more details and the corresponding proposals were captured in [1].

Based on those proposals, more companies suggest that Remote UE can receive the system information via PC5 before and after PC5 connection establishment with Relay UE. But there are also companies who think limiting the system information delivery after PC5 connection establishment with Relay UE is simple and avoid potential WG impact. As a result, the following proposal was captured:

***Proposal 15： [For discussion] Remote UE can receive the system information via PC5 before and after PC5 connection establishment with Relay UE.***

Companies are invited to address the above proposal with the following question:

**Q9: When can Remote UE receive the system information via PC5?**

* **Option 1: before PC5 connection establishment with Relay UE**
* **Option 2: after PC5 connection establishment with Relay UE**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option(s)** | **Comment** |
| Qualcomm | Option 1 and Option 2 | Option 2 is straight forward.  We do think Option 1 is also necessary at least for OOC remote UE for its initialization of RRC establishment; Otherwise, OOC remote UE has to establish unicast PC5 connection to get necessary SIB info related to RRC establishment. It will introduce extra latency for OOC remote UE to start its RRC establishment, which may be inefficient and time consuming because the serving cell of relay may not a good choice for the remote UE.  For Option 2, some companies have concern that broadcasting it may bring large overhead. However, we think only a small set of MIB+SIB1 (only 16.3%) is required. It should resolve the concern of overhead |
|  |  |  |

**Summary:**

At last RAN2#113bis-e meeting, with regard to which SIB(s) can be forwarded by Relay UE to Remote UE, there are quite divergent views. Therefore, no agreement has been achieved on this issue yet.

Companies have further considered this issue with more details and arguments, as captured in [1].

It is noticeable that among all the existing system information, e.g., MIB and SIB1~14, for which SIB(s) can be forwarded, we can consider the concept of minimum SI or essential SIB(s) and other SI. Because for the minimum SI or essential SIB(s) which is used for camping on a cell, they are always periodically broadcasted by default, and for the other SI which is used for specific purpose, they canl be acquired on demand. Moreover, considering minimum SI or essential SIB(s) may also impact RAN2 design on how SIB(s) can be forwarded. Therefore, Rapporteur suggests to firstly decide whether minimum SI or essential SIB(s) needs to be defined for Remote UE. Otherwise, all system information may be delivered in a on-demand fashion. The summary captures two proposals as:

***Proposal 16： [For discussion] RAN2 to decide whether minimum SI or essential SIB(s) should be defined for Remote UE.***

***Proposal 17： [For discussion] If minimum SI or essential SIB(s) is supported, whether the minimum SI or essential SIB(s) should be defined before or after the remote UE PC5 connection establishment with Relay UE***

Companies are invited to address these two proposals as follows:

**Q10-1: Do companies agree that minimum SI or essential SIB(s) should be defined for Remote UE, i.e. forwarded by default?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Yes before PC5 connection;  No after PC5 connection | Before PC5 connection, because it has to be broadcast by relay, we think it is necessary to reduce payload size. We prefer to only broadcast minimum SI (i.e. a small set of SIB1+MIB) via "Relay Discovery Additional Information” as agreed in SA2. It is intended for OOC remote UE to initialize its RRC establishment. Specifically, the small set of SIB1 + MIB is with ~367bit, which includes PLMN ID (~75bit), TAC (24bit), ranac (7bit), cell ID (36bit), t300 (3bit), t319 (3bit), *useFullResumeID* (1bit) and UAC config (~217bit). It is only 16.3% compared with total payload size of MIB+SIB1. We can further discuss whether UAC config is needed. If without UAC config, it is only ~150bit.  After PC5 connection, cconsidering different remote UEs may have different interest/capability, we think there is no need to restrict which SIBs should be forwarded by relay, i.e. when to forward and which SIB to forward can be left to relay UE implementation. |
|  |  |  |

**Q10-2: If ANS to Q10-1 is YES, do companies think that minimum SI or essential SIB(s) should be forwarded for Remote UE:**

1. **Before the Remote UE PC5 connection establishment with Relay UE**
2. **After the Remote UE PC5 connection establishment with Relay UE**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option?** | **Comment** |
| Qualcomm | a) | As we indicated in Q10-1. |
|  |  |  |

**Summary:**

On how SIB(s) can be forwarded, RAN2 agreed to use PC5 RRC message to forward SIB(s). However, the cast type(s) of the PC5 RRC message has not been decided yet.

Agreements:

Proposal 10-2: [23/23] [Easy] PC5-RRC message can be used to carry the system information forwarding via PC5.

There was many proposals addressing this issue, including unicast, broadcast or groupcast. But, from rapporteur point of view, how SIB(s) can be forwarded has dependency on whether minimum SI or essential SIB(s) is defined or not. In other words, if minimum SI or essential SIB(s) is defined for Remote UE, then they can be broadcasted periodically by Relay UE similar as legacy. Otherwise, unicast may be more suitable for SI delivery based on Remote UE’s request. Thus, is was proposed in the summary that:

***Proposal 18： [Lower priority] RAN2 to discuss how SIB(s) can be forwarded after decision on if minimum SI or essential SIB(s) is defined for Remote UE.***

For in-coverage Remote UE, the allowed SIB delivery path is a left issue from the last meeting.

*Proposal 2-6: [Lower priority] RAN2 to discuss whether in coverage remote UE is allowed to directly receive the system information via Uu after connected to relay UE.*

Companies still have divergent views on whether IC remote UE shall be allowed to directly receive the system information via Uu after connection relay UE. it was proposed:

***Proposal 19： [Lower priority] For IC, RAN2 to discuss whether Remote UE shall be allowed to request and receive SI over direct (Uu) path. FFS on any enhancement to Remote UE if both direct (Uu) path and indirect (relay) path are available for SI request and reception.***

Thus, to address this issue and strive for some progress, companies are invited to address the following question:

**Q11: Do companies think that IC Remote UE can be allowed to request and receive SI over direct (Uu) path?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | Although we prefer a simpler remote UE behavior to always receive SIB from indirect path after PC5 connection, it is indeed tricky that remote UE needs to also receive SIB of neighbor cell which should be allowed to receive via direct path.  To avoid further discussion (i.e. specifying when to receive SIB from direct path), we prefer to agree that it is up to remote UE implementation whether to receive SIB from direct or indirect path. |
|  |  |  |

**Summary:**

## Paging

Based on Relay UE RRC state, i,e., IDLE/INACTVE/CONNECTED, Relay may monitor and forward CN paging for an IDLE remote UE connected through PC5 or monitor and forward RAN paging for an INACTIVE remote UE connected through PC5. With regard to relay paging monitoring paging for remote UE connected through PC5.

With regard to Paging monitoring when Relay UE in IDLE/INACTVE/CONNECTED, there common understanding that Relay UE in RRC IDLE or RRC INACTVE can monitors paging occasions of its PC5-RRC connected Remote UE. But, for Connected mode Relay UE, UE behavior may not the same. The remote UE in UEs in RRC\_CONNECTED may have to monitor for SI change indication or for indication about PWS notification in any paging occasion. Thus, the summary proposed:

***Proposal 20： [Easy] When a Relay UE in RRC IDLE or RRC INACTVE, the Relay UE monitors paging occasions of its PC5-RRC connected Remote UEs.***

***Proposal 21： [For discussion] When Relay UE in RRC CONNECTED and Remote UE in RRC\_IDLE/RRC\_INACTIVE, whether the Relay UE monitors PO of its PC5-RRC connected Remote UE(s) or receive paging message of the Remote UE(s) through dedicated RRC message.***

***Proposal 22： [For discussion] When Relay UE in RRC CONNECTED and remote UE in RRC CONNECTED, Relay UE may monitor only for SI change indication and/or PWS notifications in any PO.***

Companies are invited to address the above proposals in:

**Q12-1: Do companies agree that when Relay UE in RRC IDLE/RRC INACTVE and Remote UE in RRC IDLE/RRC INACTIVE, the Relay UE monitors paging occasions of its PC5-RRC connected Remote UE(s)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | In addition, we prefer to make the proposal clearer:   * INACTIVE relay UE can monitor and forward CN paging for an IDLE remote UE, without transition to IDLE state due to CN paging for remote UE. * IDLE relay UE can monitor and forward RAN paging for an INACTIVE remote UE. |
|  |  |  |

**Q12-2: Which option is preferable when Relay UE in RRC CONNECTED and Remote UE in RRC\_IDLE/RRC\_INACTIVE?**

* **Option 1: The Relay UE monitors PO of its PC5-RRC connected Remote UE(s)**
* **Option 2: The Relay UE receives paging message of the Remote UE(s) through dedicated RRC message**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option?** | **Comment** |
| Qualcomm | Option 2 | The fatal issue of Option 1 is that it will mandate Network to configure common CORESET and common Search Space for paging in all BWPs. Note that 38.300 has captured that  “*In case of BA, a UE in RRC\_CONNECTED only monitors paging channels on the active BWP with common search space configured.*”  Then, it is almost impossible for Network because only up to 3 common CORESET and up to 10 common search space can be configured across all BWPs in one cell, according to 38.331. If we have totally 4 BWPs, it is impossible to support.  Furthermore, option 2 has benefit to save relay UE’s power caused by paging monitoring, especially when many remote UEs are connected to the relay. |
|  |  |  |

**Q12-3: Do companies agree that when Relay UE in RRC CONNECTED and Remote UE in RRC CONNECTED, Relay UE may monitor for SI change indication and/or PWS notifications in any PO?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | According to 38.300, a CONNECTED UE only needs to monitor paging for PWS and SIB update in any PO.  *“When in RRC\_CONNECTED, the UE monitors the paging channels in any PO signalled in system information for SI change indication and PWS notification.”*  Then, relay UE anyway needs to monitor paging for PWS and SIB update (and forward necessary ones to remote UE) because SIB change is common to relay and remote UE. We don’t need relay to use extra power to monitor remote UE’s paging on PWS/SIB update. |
|  |  |  |

**Summary:**

On whether Short message forwarding should be supported, companies’ proposals views are split, thus, it was proposed to discuss this issue in:

***Proposal 24： [For discussion] RAN2 to decide whether Short Paging message forwarding over sidelink is supported in Rel-17.***

In NR Uu , Short Messages can be transmitted on PDCCH using P-RNTI with or without associated Paging message using Short Message field in DCI format 1\_0 (see TS 38.212 [17], clause 7.3.1.2.1). Similarly, supporting Short Message over sidelink may require extra specification impact, e.g., RAN1 involvement. Thus, simplify the work Rapporteur think we should avoid supporting Short Message forwarding over sidelink, thus companies are invited to provide their view on following question:

**Q13: Do companies agree that Short Message forwarding over sidelink is not needed in Rel-17?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | See comments | We think the question is not quite clear: does “short message forwarding” means the DCI or one indication on PWS/SIB-update? If it is former, we don’t think it can work because it implies to introduce a new PC5 physical. For the later, we are neutral to allow relay UE to notify remote UEs on PWS and SIB-update so that remote UE can initialize on-demand SIB procedure (if needed), especially when some SIBs are not broadcasted by relay. |
|  |  |  |

**Summary:**

With regard to PO overlapping, there was some discussion there may be cases that: Relay UE and remote UE POs are overlapping and Relay UE and remote UE POs are NOT overlapping. In case the POs of the relay UE and remote UE are not, it easier for the relay UE to distinguish what is for himself and what is for the remote UE. But, in case Relay UE and remote UE POs are overlapping it may not be easier.

Based on proposals submitted, on how the relay UE can distinguish what is for himself and what is for the remote UE may require some consideration from network side when sending the paging message for remote UE. A specified solution or network implementation are possible, thus, the summary captured:

***Proposal 25： [Lower priority] RAN2 to study if any potential issue and solution needed on Remote UE and Relay UE PO overlapping case****.*

Companies are invited to address this proposal as:

**Q14: Do companies agree that Remote UE and Relay UE PO overlapping case should be considered later, e.g. after paging forwarding mechanism is clear?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | No | We don’t see any issue when PO is overlapping. Our understanding is that relay UE will anyway decode paging record to get the included 5G-S-TMSI or I-RNTI (as legacy). So, it knows whether paging of remote UEs are included. If yes, relay can forward the paging record to all possible remote UEs associated to the PO. |
|  |  |  |

**Summary:**

On how paging message is forwarded, in RAN2#113bis meeting, it is agreed that unicast can be used for paging forwarding via PC5 as follows.

|  |
| --- |
| Proposal 13: [23/23] [Easy] Unicast can be used for the paging forwarding via PC5. |

On how the paging message is forwarded is further considered on whether a new PC5 RRC is used and whether Broadcast and group cast can also be used for the paging forwarding. based on proposal submitted it was proposed:

***Proposal 26： [Lower priority] A new PC5-RRC message is needed to relay the paging information from relay UE to Remote UE for unicast.***

Rapporteur thinks this should be addressed but not with urgency, but companies are still invited to express their view on:

**Q15: Do companies agree that A new PC5-RRC message is needed to relay the paging information from Relay UE to Remote UE for unicast?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | We think forwarded paging is different from existing SL-SRB0/1/2/3. And it is good to introduce a new SL-SRB for better resource management. The logical channel priority of the new SL-SRB is fixed and higher than SL-SRB3 |
|  |  |  |

**Summary:**

## 2.4. UAC

On UAC check of remote UE, In RAN2#113b-e [3], the following WA on UAC was made:

**“WA: Proposal 15: [23/23] [Easy] Remote UE can reuse legacy access control and no need to enhance the access control procedure of Remote UE. FFS whether the relay UE performs UAC”**. With regard to this WA, there are some proposals to confirm the WA as follows:

As the WA is in line with legacy procedure, and this WA is also related to other WG, RAN2 should confirm the WA. Thus, we had:

**Proposal 27： [Cross WG] Confirm the WA that Remote UE performs UAC based on legacy procedure independently.**

Rapporteur encourage companies to strive for confirming this proposal in the following question:

**Q16: Do companies agree to confirm the WA that Remote UE performs UAC based on legacy procedure independently?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree | It has already been agreed in SI |
|  |  |  |

**Summary:**

With regard to UAC check of Relay UE, on whether Relay UE can skip the UAC check when Relay UE intends to access NW only for relaying data or RRC signalling of Remote UE without any service for itself, there are many contributions, but, companies view on this issue are split as follows:

Relay UE Skip UAC: vivo, ZTE, Xiaomi, Spreadtrum, LG, OPPO

Relay performs UAC: Qualcomm, CATT, Futurewei, Huawei

Neutral: Intel, apple

Thus, it was proposed:

***Proposal 28： [Cross WG] RAN2 to discussion whether Relay UE should perform UAC or can skip UAC when it intends to access network only for the purpose of relaying but not for its own service.***

***Proposal 29： [Cross WG] Send a LS to SA2 to ask SA2 view on whether Relay UE should*** ***perform UAC or can skip UAC when it intends to access network only for the purpose of relaying but not for its own*** *service*

This skipping or performing UAC is also related to SA2, thus Rapporteur proposes to address this and inform related WG ASAP, if necessary, thus:

**Q17-1: Which option is preferable when Relay UE intends to access network only for the purpose of relaying but not for its own service?**

* **Option 1: Relay UE should perform UAC**
* **Option 2: Relay UE** **can skip UAC**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option?** | **Comment** |
| Qualcomm | Option 2 | After careful consideration, we changed our mind due to below reasons:   * Remote UE will actually go a double UAC, which will equivalently deprioritize remote UE’s RRC connection request * If agreed to support UAC in relay, RAN2 needs to introduce complex failure handling for different cases, e.g. remote UE UAC passed but relay doesn’t pass.  We try to avoid such complex discussion.   Meanwhile, as we indicated in Q2-1, assuming we do only UAC for remote UE, we think a new single establishment cause makes sense. |
|  |  |  |

**Summary:**

**Q17-2: Do companies agree to send a LS to SA2/CT1 to either inform them about RAN2 decision or to ask their view on whether perform UAC or can skip UAC when Relay UE intends to access network only for the purpose of relaying but not for its own service?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Not-agree** | **Comment** |
| Qualcomm | Agree |  |
|  |  |  |

**Summary:**

# Conclusion

The summary concludes with the following proposals:

**[Easy]**

**[Cross WG]**

**[For discussion]**

**[Lower priority**]

1. Reference
2. R2-2104738 Summary on agenda item 8.7.4.1 on L2 relay control plane vivo (Rapporteur)