**3GPP TSG-RAN WG2 #113bis-e *R2-210xxxx***

**E-meeting, April 2021**

Agenda Item: 8.7.2

Source: Ericsson

Title: Summary of [609]

Document for: Discussion, Decision

# Introduction

This is to discuss the [609] as follows.

* [AT113bis-e][609][Relay] Relay discovery configuration (Ericsson)

Scope: Discuss P1a/P4a/P9a/P9b-1/P9b-2/P9c/P12 and attempt to reach convergence.

Intended outcome: Report in R2-2104413

Deadline: Monday 2021-04-19 1000 UTC

Below proposals have been formulated according to the summary of 8.7.2 relay discovery (i.e., R2-2104297). This email discussion aims to achieve covergence on the below proposals.

**Proposal 1a: [For discussion] Discovery message use the shared resource pool as baseline. RAN2 to decide on the supporting of separated resource pool from below options:**

**Option 1: Not support separate resource pool.**

**Option 2: Also support the separated resource pool, but assume the PHY layer parameters and design will re-use the R16 legacy resource pool design.**

**Proposal 4a: [For discussion] As in LTE, the remote UE and relay UE in the RRC\_CONNECTED can use the threshold based methods as in IDLE/INACTIVE, to determine whether it is allowed to perform discovery message transmission.**

**Proposal 9a: [For discussion]**

**For discovery configuration, relay UE and remote UE use the configuration provided via dedicated signaling, if available, in RRC CONNECTED state; Relay UE and remote UE use configuration provided via SIB, if available, in RRC IDLE/INACTIVE state. FFS if relay UE and remote UE can use the configuration provided via SIB, if dedicated configuration is not available, in RRC CONNECTED state.**

**Proposal 9b-1: [For discussion]**

**L3 relay UE use pre-configuration for discovery, only if the discovery configuration is not provided by gNB (regardless not provided, or not able to provide, or not able to obtain in OOC, etc.), in case its serving carrier is not shared with carrier for sidelink operation. Otherwise, L3 relay UE use the configuration for discovery provided by gNB.**

**Proposal 9b-2: [For discussion]**

**L2 relay UE can only use the configuration for discovery provided by gNB (either via SIB or dedicated signaling).**

**Proposal 9c: [For discussion]**

**Both L2 and L3 Remote UE perform discovery based on pre-configuration, only if the discovery configuration is not provided by gNB (regardless not provided, or not able to provide, or not able to obtain in OOC, etc.), in case its serving carrier is not shared with carrier for sidelink operation. Otherwise, Remote UE use the configuration for discovery provided by gNB.**

**Proposal 12: [For discussion] Transmission power of discovery message is handled same as R16 SL data transmission.**

For rapporteur to have enough time drafting summary report, we would like to have the following two phases:

* Phase 1: collect companies’ view, by 2021-04-15 22:00 UTC
* Phase 2: rapporteur will finalize summary report based on input of phase 1 by 2021-04-19 1000 UTC

# Discussion

## Resource pool (P1a)

During the SI phase, it was highlighted by companies that, with separate resource pool, it would lead to unnecessary resource fragmentation, since the discovery resource pool will not be reused for data transmission. Meanwhile, discovery message has relatively small size, and long transmission periodicity. A separate resource pool would also cause low resource utilization efficiency. It was also highlighted that there will be a risk of unnecessary signaling overhead due to the support of dedicated resource pool for discovery.

Meanwhile, RAN2 has already agreed to transmit discovery message over SL communication channel. It would be very natural to let discovery and SL communication to share a common resource pool.

For P1a, it seems that companies have no concern to support shared resource pool. Anyway, it would be beneficial to double check companies views on whether shared resource pool can be agreed as the baseline.

**Q1-1: do companies agree that shared resource pool shall be the baseline for discovery message transmission/reception?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | See comments | We think shared pool will have RAN1 impact if fixed transmission power is used for discovery. We have provided justification in Q7 that fixed transmit power is only feasible for separate pool unless RAN1 input is involved. Otherwise (if no RAN1 work), we can only reuse variable transmit power for shared pool. So, the issue is coupled with each other. |
| Huawei, HiSilicon | Yes | For QC’s comments, fixed transmission is not needed. |
| ZTE | Yes | We think both shared resource pool and dedicated resource pool should be supported. And shared resource pool can work as baseline. |
| Nokia | Yes | Shared resource pool for discovery message has been agreed as baseline in SI. Arguments concerning shared vs. dedicated resource pool for discovery message have been exchanged in SI phase already as well - there is no need to reiterate the same preferences here. |
| InterDigital | Yes | Shared resource pool has better resource utilization and should be considered the baseline. Also, we should down-prioritize any work on dedicated resource pool, since we do not need to have two different schemes for discovery transmission. |
| CATT | Yes |  |
| OPPO | Yes |  |

In addition, R2-2104297 has suggested two options regarding shared resource pool for discovery message transmission/reception for further discussion. It is worth to check companies views on the two options

**Q1-2: regarding shared resource pool, which option do companies prefer?**

* **Option 1: No support of separate resource pool.**
* **Option 2: Also support the separated resource pool, but assume the PHY layer parameters and design will re-use the R16 legacy resource pool design.**
* **Option 3: Other (please specify in the comments section)**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comments |
| Qualcomm | Option 2 | As analysed in our contribution, shared pool and separate pool are not mutual-exclusive but provide a more flexible/ complementary way of discovery transmssion for Network vendor and operators.  Cons of separate pool is resource fragments as Rapporteur summarized. But it has benefits on UE power saving, dedicated power control, RSRP measurement and allow flexibility to support “operator managed” and “non-operator managed”. We should provide Network this flexibility/option.  Furthermore, we don’t think any PHY enhancement is required for separate pool. Resource pool configuration is same as Rel-16. And the only spec impact is to introduce a new IE to indicate which resource pool IDs can only be used for discovery. We think it is a small signalling change. |
| Huawei, HiSilicon | Option 1 | Also agree on the no R1 impact for separated resource pool. |
| ZTE | Option 2 | For a given gNB, it may select to configure either shared resource pool or dedicated resource pool. Shared resource pool may help to improve spectrum efficiency. However, separate resource pool is more power efficient for UE. For example, some UE may only interest to the discovery monitoring. Separate discovery resource pool may reduce the number of resources that UE should monitor. |
| Nokia | Option 1 | While many arguments (pro & cons) have been exchanged in the SI phase, we do not think that listing, repeating and counting the number of arguments will help. The individual arguments for/against shared vs. dedicated resource pool do not have equal weight. As discussed by the rapporteur, the resource efficiency and resource utilization is the No.1 criterion (e.g. better power saving does NOT outweigh resource fragmentation for example). We simply can not afford reserving a dedicated resource pool (with at least the size of one subchannel) solely for the purpose of transmitting discovery messages every now and then. Furthermore it has been repeatedly stated that there are no RAN1 TUs allocated for SL\_relay. |
| InterDigital | Option 1 | Given the limited time to complete discovery by the target in the WID, we suggest to work on only a single design for discovery transmission. There seems no direct advantage to support both. |
| CATT | Option2 | During SI stage, the pros and cons of separate and shared resource pool were discussed. It's not easy to say which one is better, so we prefer both and leave it to gNB implementation. |
| OPPO | Option2 | Furthermore, it is suggested to apply the same MAC design for both shared resource pool and separated resource pool. |

## Discovery trigger for UE in Connected (P4a)

P4a is regarding whether remote UE and relay UE can reuse LTE rules to determine whether discovery message transmission is allowed. From Rapporteur understanding perspective, reusing LTE rules would be beneficial to reduce design efforts for RAN2 in order to complete the design work for discovery before June. Anyway, it is worth to clarify companies views on whether LTE rule shall be reused.

**Q2: do companies agree to support the LTE rule for determining whether remote UE and/or relay UE in RRC CONNECTED can trigger discovery message transmission, i.e., the remote UE and relay UE in the RRC\_CONNECTED can use the threshold based methods as in IDLE/INACTIVE, to determine whether it is allowed to perform discovery message transmission?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | We don’t any reason why LTE rule can’t be reused. And as Rapporteur suggested, it will be beneficial to reduce design efforts to complete the work by June. |
| Huawei, HiSilicon | Yes, but | Fine with P4a itself. But we should use the threshold configured in the dedicated signalling, since NW may provide flexible and difference control for UE in connected, compared to that in idle/inactive.  Please note the agreement seems already verify this proposal: “=>Trigger of relay selection: Triggered at remote UE when: a) direct Uu link quality is below a configured threshold for an in-coverage remote UE (in IDLE/INACTIVE and CONNECTED for L3 U2N relay; ; L2 case to be further discussed”). |
| ZTE | Yes | According to the WID, LTE discovery mechanism for SL relay should be reused as baseline. In LTE, no matter which RRC state the remote/relay UE is in, it uses the threshold based method for discovery message transmission trigger. It is suggested to follow this baseline. |
| Nokia | Yes | LTE rules wrt trigger of sending discovery message can be taken as baseline. |
| InterDigital | Yes |  |
| CATT | Yes | We think there is no good reason that we should reject this proposal. |
| OPPO | Yes | However, we understand that in LTE   * For remote UE, yes threshold is needed for both CONNECTED and IDLE/INACTIVE * For relay, threshold is limited to IDLE/INACTIVE, but not for CONNECTED (2nd bullet)   so we are fine to align for simplicity, but the “.. supporting LTE rule..” would be misleading |

## Discovery configuration (P9a)

Regarding P9a, as summarized in R2-2104297, companies have different views on the FFS point from SI phase: whether L2 remote UE, in OOC and connected to gNB indirectly, is allowed to transmit discovery message based on configuration provided by the gNB. According to P9a, it is suggested to raise the below questions to collect company views.

**Q3-1: for discovery configuration, can relay UE and remote UE in RRC CONNECTED use the configuration provided via dedicated signalling if available**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | See comments | If it is a relay or remote UE directly connected to gNB, we agree. But if it is a OOO remote UE indirectly connected to gNB (i.e. via L2 relay), we prefer to only use pre-configuration. Otherwise, we think maybe RAN2 need to introduce a new RRC state: RRC\_CONNECTED OOC UE because not all the functionalities for RRC\_CONENCTED defined in section 4.2.1 of TS 38.331 are applied in this case  Thus, we can agree this proposal if putting an FFS OOO remote UE indirectly connected to gNB in L2 relay. |
| Huawei, HiSilicon | Yes | The FFS part in QC’s comment is discussed in P9c.  BTW, the proposal intension should mandatory UE to use dedicated configuration if available. So, “can”=>“should”. |
| ZTE | Yes | For L2 relay, we think that out of coverage remote UE could use the configuration provided via dedicated signalling once it connects to the network. |
| Nokia | Yes with comments | Dedicated signaling should be supported but optional for remote-UE in RRC\_CONNECTED. |
| InterDigital | Yes | For L2 relay, the remote UE is under control/configuration of the network even when OOC, and configuration of discovery should be no different than any other configuration in RRC\_CONNECTED. |
| CATT | Yes | We share the same view as HW. |
| OPPO | Yes with comment (by differentiating L2/3 relay) | We understand this Q is agreeable for L3 relay.  We assume the key FFS point is for L2 remote UE in OOC but connected to a relay UE, whether it can use dedicated discovery configuration if it is available. In that case, we think it is agreeable. From our understanding, this issue is not only targeting on NR sidelink relay discovery configuration, but also applying to other relay configuration, e.g. sidelink data transmission/reception resource pool configuration.  However, according to the LTE spec on LTE V2X/D2D, it is widely agreed that OOC UE should use pre-configuration to avoid resource interference with those partial coverage UEs, in that case, for NR sidelink-relay, so we also understand if the source of the doubt comes from whether to provide dedicated configuration for remote UE which is OOC but RRC\_CONNECTED. Therefore, if there is no convergce at current stage, this issue can be postponed to L2 specific design. |

**Q3-2: for discovery configuration, can relay UE and remote UE in RRC IDLE or RRC INACTIVE use the configuration provided via SIB if available**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes |  |
| Huawei,HiSilicon | Yes | “can”=>”should”. |
| ZTE | Yes |  |
| Nokia | Yes |  |
| InterDigital | Yes |  |
| CATT | Yes |  |
| OPPO | Yes with comment (by differentiating L2/3 relay) | We understand this Q is agreeable for L3 relay.  As mentioned above, this key FFS point is for L2 relay, but not targeting on L2/L3 common design, so it could be postponed to L2 specific design after RAN #92 meeting. And there is no big difference between L2 relay UE acquiring discovery configuration and L2 relay UE acquiring other L2 specific configuration (e.g. tx resource pool), where RAN2 can have more detailed discussion especially for the detailed procedure on how remote UE acquire SIB and how relay UE transmit SIB. |

**Q3-3: for discovery configuration, can relay UE and remote UE in RRC CONNECTED use the configuration provided via SIB signalling if the configuration configured via dedicated signalling is not available**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | See comments | Similar to Q3-1, we can agree if putting an FFS OOC remote UE indirectly connected to gNB in L2 relay. |
| Huawei, HiSilicon | No | That means the NW does not allow UE to transmit the discovery on purpose. |
| ZTE | See comments | It is necessary to clarify why the gNB does not provide dedicated resource configuration to RRC connected relay/remote UE. Is it due to the failure of relay/remote UE authorization? In that case, we think the discovery resource configuration provided in SIB should not be used. On the other hand, we think the threshold defined in SIB could be used for relay/remote UE in all RRC states. |
| Nokia | Yes | It seems a valid option if discovery configuration via SIB for relay-UE and remote-UE in RRC\_IDLE/RRC\_INACTIVE is supported in Q3-2 for IDLE/INACTIVE state. In case the remote-UE is also in-coverage the SIB might be distributed to the remote-UE either directly via Uu, indirectly via PC5 or both via both paths. |
| InterDigital | Yes | We can allow the network to support a common configuration for the cell and only change it for a specific UE in dedicated RRC signaling. |
| CATT | No | We share the same concern as HW and ZTE. |
| OPPO | Yes with comment (by differentiating L2/3 relay) | The same comment as above. |

## Discovery configuration (P9b-1)

There are diverse scenarios where L3 relay UE may not obtain discovery configuration from gNB, i.e., gNB does not provide, gNB is not able to provide or relay UE is OOC. During the SI phase, RAN2 has made the below agreement regarding the scenario where gNB is not capable of SL relay operation.

*Relay UE supporting L3 UE-to-Network Relay is allowed to transmit discovery message based on at least pre-configuration when it is connected to a gNB which is not capable of sidelink relay operation, in case its serving carrier is not shared with carrier for sidelink operation*.

Nevertheless, it would straightforward to extend the agreement for other scenarios where L3 relay UE is not able to obtain discovery configuration from gNB.

**Q4: do companies agree that L3 relay UE uses pre-configuration for discovery, only if the discovery configuration is not provided by gNB (regardless not provided, or not able to provide, or not able to obtain in OOC, etc.), in case its serving carrier is not shared with carrier for sidelink operation. Otherwise, L3 relay UE uses the configuration for discovery provided by gNB**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | It is aligned with SI conclusion |
| Huawei, HiSilicon | Yes |  |
| ZTE | See comments | Not sure if we consider the authorization impact here. Suppose the RRC connected L3 relay UE is not authorized for relay operation and gNB does not provide the discovery configuration to relay UE via dedicated signalling, should it be allowed to use pre-configuration on the PC5 carrier?  [Huawei] The non-authorized UE should not transmit data for relay. But, the discovery should be fine, which cause no resource from gNB instread just PC5 resource. BTW, L3 authorization is transparent to gNB. |
| Nokia | comments | We share the concern raised by ZTE – the intention of the question is not clear to us: are we discussing gNB capability wrt to support relay or an relay-UE authorization issue ? |
| InterDigital | Yes |  |
| CATT | Yes |  |
| OPPO | Yes |  |

## Discovery configuration (P9b-2)

During the SI phase, RAN2 has made the below agreement regarding L2 relay UE,

*Relay UE supporting L2 UE-to-Network Relay should be always connected to a gNB which is capable of sidelink relay operation including providing configurations for transmission of discovery messages.*

Since L2 relay UE is always connecting to a gNB which is SL relay operation capable, it would be straightforward to assume that L2 relay UE will always use the discovery configuration provided by gNB.

**Q5: do companies agree that L2 relay UE will always use the discovery configuration provided by gNB (either via SIB or dedicated signalling)**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes | It is aligned with SI conclusion |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |
| InterDigital | No | The same rule as L3 relay could be applied here. If the gNB is SL relay capable but does not provide discovery, the relay UE could use preconfiguration if the serving carrier is not shared with the carrier for sidelink.  [Huawei]: This proposal is agreed and confirmed in SI phase. |
| CATT | Yes |  |
| OPPO | Yes |  |

## Discovery configuration (P9c)

During the SI phase, RAN2 has made the below agreement regarding remote UE discovery,

*Remote UE supporting UE-to-Network Relay is allowed to transmit discovery message based on at least pre-configuration when it is directly connected to a gNB which is not capable of sidelink relay operation, in case its serving carrier is not shared with SL carrier.*

*- For Remote UE supporting L2 UE-to-Network Relay which is out of coverage and connected to a gNB indirectly, whether it is allowed to transmit discovery message based on configuration provided by the gNB can be discussed in WI phase.*

Regardless whether remote UE is IC or OOC, whenever remote UE is able to obtain discovery configuration from gNB (i.e., either directly from gNB or indirectly from gNB via a relay UE), it is beneficial for remote UE to use the discovery configuration provided by the gNB to achieve better flexibility and better resource utilization efficiency. In other words, remote UE shall use discovery pre-configuration only when discovery configuration from gNB is not available. Therefore, we raise the below question

**Q6: do companies agree that Remote UE (regardless of L2 relaying or L3 relaying) performs discovery based on pre-configuration, only if the discovery configuration is not provided by gNB (regardless not provided, or not able to provide, or not able to obtain in OOC, etc.), in case its serving carrier is not shared with carrier for sidelink operation. Otherwise, Remote UE uses the configuration for discovery provided by gNB**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Partly | For remote UE in L3 relay, we agree.  For remote UE in L2 relay, we have same concern on case of OOC remote UE indirectly connected to gNB in L2 relay. We are a little confused with the concept of “RRC\_CONNECTED” in this case. Thus, we suggest to put a FFS OOC remote UE indirectly connected to gNB in L2 relay.  Rapp: suggest to add the otherwise part to address QC’s concern. The otherwise part was in P9c. |
| Huawei, HiSilicon | Yes | This question cover the FFS mentioned by QC. Share the views from rapporteur.  For L2 OOC remote UE connected indirectly via relay UE, it met the “otherwise” case, i.e. UE is able to obtain the gNB provided configuration. So, remote UE should not use the pre-configuration.  The argument is clear that L2 OCC remote UE should under gNB control rather than pre-configuration control. |
| ZTE | See comments | Similar to comments for Q4. Not sure if we consider the authorization impact here. Suppose the RRC connected L2/L3 relay UE is not authorized for relay operation and gNB does not provide the discovery configuration to relay UE via dedicated signalling, we think it should be not allowed to use pre-configuration on the PC5 carrier not shared with Uu carrier.  [Huawei]: Why gNB still allow UE in connected if it is not authorized? |
| Nokia | comments | Why are Q4 and Q6 handled in different questions ? As stated we share the concerns raised by ZTE. |
| InterDigital | Yes |  |
| CATT | Yes | We agree the otherwise part proposed by rapporteur and share the same view as HW. |
| OPPO | See comment (intra-carrier case is missing) | The intra-carrier case is missing,   * For L2 remote UE, see comment in Q3-1 and Q3-2, i.e., pre-configuration should be used before remote UE connects to relay UE, and also after connecting to relay UE but fail to get the configuration from network yet. * For L3 remote UE, obviously pre-configuration can be used when remote UE is OOC. |

## Discovery transmission power (P12)

In R2-2104297, for the transmission power of discovery message, the following options are proposed by companies.

**Option 1**: Transmission power of discovery message is handled same as normal SL data transmission, i.e. transmit power subject to OLPC (Open Loop Power Control).

**Option 2**: Transmission power of discovery message is fixed.

From Rapporteur’s understanding perspective, in Rel-16, PSSCH transmission power for unicast is subject to OLPC. A TX UE determines its transmission power for a PSSCH transmission based on report message of CSI measurement provided by RX UE. This requires that the unicast link between TX UE and RX UE needs to be established. Based on the CSI report message provided by RX UE, TX UE can estimate the pathloss of the SL link. For discovery message, the similar framework can not be directly reused, since the discovery message is transmitted in broadcast fashion. So, RX UE is not able to provide CSI report via a unicast link to TX UE. Therefore, TX UE can not consider SL pathloss to perform OLPC. Meanwhile, it may be feasible for TX UE to consider its DL pathloss towards gNB in certain scenarios. Then, TX UE may be able to consider its DL pathloss to perform OLPC, so to avoid interference to Uu transmission due to discovery message. However, when UE triggers discovery transmission, UE is typically OOC, therefore, DL pathloss is not always feasible to be considered. As a conclusion, the above issues need to be addressed in order to apply OLPC for discovery, which is in RAN1 scope, while there is no RAN1 TU allocated.

On the contrary, reuse LTE rule for discovery transmission, i.e., use a fixed transmission power would be simple and avoid unnecessary design efforts for RAN2.

Therefore, rapporteur would like to raise the below question to check companies’ views.

**Q7: do companies agree that discovery transmission uses a fixed transmission power as in LTE**?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Qualcomm | Yes for separate pool. Not feasible for shared pool unless RAN1 input | For shared pool, it can only reuse Rel-16 SL data transmission with power control based on CBR and downlink pathloss with gNB. That is because power control is performed in PHY layer which doesn’t know whether it is discovery or PC5 comm. Because we only introduce MAC differentiation for discovery (i.e. LCID) and there is no indication from MAC to PHY to tell PHY this is discovery.  According to SL power control formular:  [dBm]  is DL path-loss based, and is SL path-loss based which is used for unicast only.  The only difference is that it is not unicast, it can’t apply power control based on Sidelink pathloss ().But UE still uses ( and () for power control because it doesn’t know it is discovery. Among them, CBR part (is still used to avoid congestion and downlink pathloss () is still used to control SL interference to gNB.  For separate pool, we think it is feasible to use fixed transmission power because PHY can know it is discovery via resource pool type. |
| Huawei, HiSilicon | No | “However, when UE triggers discovery transmission, UE is typically OOC” seems not correct, since we do support the IC relay UE and remote UE for U2N relay.  For shared pool case, we agree with QC, that it is always OLPC.  For separate pool case, why don't we just follow the R16 design to avoid any PHY enhancement and R1 discussion? |
| ZTE | Option 1 | We think the SL discovery message should be transmitted as normal SL communication packet. So it should also follow the power control rule for SL communication. |
| Nokia | Option 1 | The fixed power vs. OLPC discussion is another pseudo argumentation to substitute the already well-disucssed shared vs. dedicated carrier question. |
| InterDigital | No | OLPC for broadcast transmissions is used to avoid interference to the gNB (by considering the DL pathloss) and congestion (by considering the CBR). This should also apply to discovery transmissions, not just to data. In addition, this would generally apply regardless if we have shared or dedicated resource pool. |
| CATT | See comment | Considering that the final decision has not yet made for shared vs.dedicated resource pool, we can first collect information and leave the final decision to the next meeting. |

1. xxx.

# Conclusion

We have the following proposal:

[Proposal 1 xxx.](#_Toc69160470)

# Reference

1. R2-2104297 Summary of 8.7.2 relay discovery Huawei, HiSilicon