**3GPP TSG RAN WG2 Meeting #115-e R2-210xxxx  
Electronic Meeting, 16th - 27th August 2021**

**Agenda item: 8.7.3.1**

**Source: CATT**

**Title: [AT115-e][617][Relay] Continuation of discussion on discovery (CATT)**

**Document for: Discussion and Decision**

# Introduction

This is email discussion for below offline discussion:

* [AT115-e][617][Relay] Continuation of discussion on discovery (CATT)

Scope: Discuss the following questions on discovery:

* Whether the network can configure shared and dedicated pool for discovery simultaneously
* Resource allocation modes for discovery (P2/P3/P4/P5 of R2-2106994)
* Multiplexing in shared pool (P1 of R2-2107089)
* BSR for discovery transmission (P4/P5 of R2-2107089)

Intended outcome: Report to comeback session, in R2-2108949

Deadline: Tuesday 2021-08-24 2000 UTC

After the Weekend break and before the deadline, we fail to see the possibility to arrange a two-stage discussion as normal. Hence please pay attention, the current email discussion will be carried out by just only one stage, and the deadline for you to participate in this email discussion is 8/24 08:00 UTC.

# Discussion

## Whether the network can configure shared and dedicated resource pools for discovery simultaneously?

During the online discussion, regarding to the discovery, whether the network can configure shared and dedicated resource pools simultaneously was discussed and no common understanding was reached. In the voting, 11 companies support it while 9 companies do not support it. Since there is great divergence, hence, in this email discussion, this issue will be further discussed.

In order to gather companies’ view on this point, in the following question, we listed all the possible options on the resource pool configuration from the network perspective. Companies are encouraged to provide their arguments on why they select this option but not the others.

**Question 1-1: From the network perspective, in case of there is both sidelink communication and sidelink discovery UE in the network, which option is possible when configuring the Tx resource pool? Please give your comments.**

* **Option 1: Only shared resource pool(s);**
* **Option 2: Shared resource pool(s) and discovery dedicated resource pool(s);**
* **Option 3: Shared resource pool(s) and communication dedicated resource pool(s);**
* **Option 4: Only dedicated resource pool(s) for discovery and dedicated resource pool(s) for communication;**
* **Option 5: Shared resource pool(s), discovery dedicated resource pool(s) and communication dedicated resource pool(s).**
* **Option 6: (if any, please add here).**

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| **Companies** | **Option** | **Comments** |
| Qualcomm | Option 1, Option 2 | First, we don’t fully understand what is “**communication dedicated resource pool(s)” in Option 3/4/5.** Does it mean shared pools which can only be used for communication but not discovery? If yes, we don’t think RAN2 agreed such kind of pool and it is conflicted with below agreement on mode 1 in last Friday:  For mode 1, if agreed that both shared and dedicated resource pools can be configured, it is up to gNB which one the UE should use to transmit discovery message.  Secondly, please note that “configuring the TX resource pool” should include configuration both via RRC and via SIB, as agreed in last RAN2 meeting:  Proposal 3a (modified): RAN2 agree that for L2 remote UE which is out-of-coverage, but connected to network via a relay UE (i.e., either in RRC CONNECTED or RRC IDLE/INACTIVE), it should follow network configuration, i.e., SIB or dedicated signalling, if available.  Then, because it is possible that the cell has both sidelink communication and sidelink discovery UE, NW can provide only shared pool (Option 1), or both shared pool and dedicated pool simutenously at least in SIB for IDLE/INACTIVE (Option 2). Thus, this scenario may happen.  On whether NW can simutenously configure both shared pool and dedicated pool in RRC, we agree with some company that it seems no strong motivation, but prefer to leave the option to NW (i.e. not prohibit it in spec and up to NW whether to configure it). |
| OPPO | Option1/4 | Firstly, we do not think the Q is clear from network perspective, since whether a resource is “shared” by communication and discovery (ie., overlapping t/f resource(s) is used for communication and discovery by the same/different UEs) is not known/cared by UE.  The UE only cares, the behavior w.r.t. the two types of resource pools:   1. Shared pool: the pool where both communication and discovery can use; 2. Dedicated pool: the pool where only discovery can use;   so our response is base on the understanding above, and here we did not touch the part for exceptioanl pool but focusing on the pools for normal use case (we understand the exceptional pool may need separate discussion)  To us, option 1 is the baseline solution for transmission of both data and discovery message transmission.  For option 4, we think if legacy resource pools and dedicated resource pool for discvoery are both configured, legacy pool anyway shall be configured to transmit data for communication only, and discovery dedicated resource pool shall be used to transmit discovery message only. I.e., the “**dedicated resource pool(s) for communication**” in option-4 in our view is the legacy resource pool configuration. |
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During the online discussion, we made the following agreements:

For mode 1, if agreed that both shared and dedicated resource pools can be configured, it is up to gNB which one the UE should use to transmit discovery message.

For mode 2, if agreed that both shared and dedicated resource pools can be configured, downselect from the following options:

* Left to UE implementation
* Dedicated pool should be prioritised
* Shared pool should be prioritised

The above agreements is based on the pre-condition that both shared and dedicated resource pool can be configured (Option 3 in Question 1-1), Hence for companies who do not support Option 3 in Question 1-1, we want to further gather their view why this option is not selected, please give your detailed arguments for the objection.

**Question 1-2: From the network perspective, if you don’t support option2 in Q1-1, please give your detailed arguments for the objection.**

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| **Companies** | **Comments** |
| OPPO | With the following FFS point in agreement  FFS if the network can configure shared and dedicated pool simultaneously.  We understand this pre-condition needs to be further checked,  We do not think the online discussion defines the “shared”/”dedicated” resource pool in a rigorous way, and  As replied to Q1-1, we understand it is more rigorous to define dedicated/shared pool from UE perspective, i.e., the pool is dedciated (or shared) if the resource pool can only be used for discovery traffic (or both discovery and communication traffic).  From that perspective, our preference is that it is only necessary to configured 1) either resource pool(s) shared by communication and discovery (i.e., no dedicated resource pool), 2) or resource pool(s) dedicated to communication traffic only, and resource pool(s) dedicated to discovery traffic only.  We do not see the need for configuring both shared pool(s) and dedicated pool(s) yet. |
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## Resource allocation mode for sidelink discovery

In this meeting, contributions [1], [3] and [4] discussed the issue of discovery resource allocation mode. The corresponding proposals were summarized as below:

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| **Company** | **Proposals** |
| R2-2106994 | **Proposal 2: For relay UE, when performing sidelink discovery, both mode 1 and mode 2 resource allocation modes can be supported, and which one will be used can be determined based on legacy Rel-16 resource allocation mode selection mechanism.**  **Proposal 3: For IC remote UE which has not been connected to network via a relay UE, both mode 1 and mode 2 resource allocation modes can be supported, and which one will be used can be determined based on legacy Rel-16 resource allocation mode selection mechanism.**  Proposal 4: For IC remote UE which has already been connected to network via a relay UE, it is slightly prefers that only resource allocation mode 2 can be used to transmit the sidelink discovery message.  **Proposal 5: For OOC remote UE, it is slightly prefers that only resource allocation mode 2 can be used to transmit the sidelink discovery message.** |
| [R2-2107313](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2107313.docx) | **Proposal 2: RAN2 to discuss and confirm that the dedicated resource pool for discovery shall support both mode-1 and mode-2 resource allocation.** |
| [R2-2108152](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2108152-Relay%20Discovery%20for%20stage%203.docx) | **Proposal 2: Relay UE supports SL mode1 and mode2 for discovery message transmission.**  **Proposal 3: We need to discuss whether to supports that Remote UE transmits discovery messages using mode 1 operation after the Remote UE becomes in RRC CONNECTED via Relay UE**  **Proposal 4: After the Remote UE becomes in RRC CONNECTED via Relay UE, Remote UE can be allowed to use only mode2 for transmitting discovery messages. It may reduce complexity and latency.** |

For relay UE, since it is IC, hence when the relay UE performing sidelink discovery transmission, it is reasonable to follow the legacy Rel-16 mechanism that is both mode 1 and mode 2 resource allocation modes can be supported.

For IC remote UE, two cases should be considered:

* Case 1: IC remote UE which has not been connected to network via a relay UE.
* Case 2: IC remote UE which has already been connected to network via a relay UE.

For Case 1, since the remote UE has direct Uu link, similar as the IC relay UE, it is reasonable to support both mode 1 and mode 2. For Case 2, since the remote UE is connected to network via a relay UE, it is naturally that resource allocation mode 2 can be used, but it is doubtable whether resource allocation mode 1 can be supported. In addition, considering mode 1 includes both dynamic scheduling, type 1 configured grant and type 2 configured grant, if mode 1 can be supported, it should further discuss whether all of these three scheduling strategies can be supported or only type 1 configured grant can be supported.

Similarly, for OOC remote UE, there are also two cases should be considered:

* Case 1: OOC remote UE which has not been connected to network via a relay UE.
* Case 2: OOC remote UE which has already been connected to network via a relay UE.

For Case 1, it is obvious that only resource allocation mode 2 can be supported. For Case 2, same as the analysis for IC remote UE, it should further discuss whether both mode 1 and mode 2 can be supported.

**Question 2-1: In case of sidelink discovery, for IC relay UE or remote UE with direct Uu link, which resource allocation mode can be supported? Please give your comments.**

* **Option 1:** **Only mode 1 can be supported.**
* **Option 2: Only mode 2 can be supported.**
* **Option 3: Both mode 1 and mode 2 can be supported.**

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| **Companies** | **Option** | **Comments** |
| Qualcomm | Option 3 | It is same as Rel-16 V2X |
| OPPO | Option3 | We assume the “**remote UE with direct Uu link**” means the “IC remote UE which has not been connected to network via a relay UE”. |
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During the online discussion, regarding to the resource allocation for sidelink communication, it was agreed that:

Proposal 17: [Easy] In this release, for L2 U2N relay, remote UE can be configured to use resource allocation mode 2 if relay connection has been setup. FFS for CG type 1.

Regarding to the resource allocation of sidelink discovery, for IC or OOC remote UE which relay connection has been setup, it is obvious that the same rule can be applied.

**Question 2-2: In case of sidelink discovery, for IC or OOC remote UE which relay connection has been setup, do companies agree to use the same rule as sidelink communication? That is resource allocation mode 2 can be used, FFS for CG type 1? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| Qualcomm | No (Mode 2 only) | As discussed online last Friday, dynamic scheduling and CG type 2 can’t work because Uu L1 signaling (i.e. UL grant and DCI to activate/deactivate CG type 2) can’t be forwarded in at least in this release.  For CG type 1, we agree PUCCH can be disabled to make it work. However, this is not a complete CG type 1, and thereby its impact/issue should send LS to RAN1 for issue checking if RAN2 agree to support it. From our perspecitve, we think mode 2 is sufficient in this release, and prefer to make life eaiser (i.e. Mode 2 only). |
| OPPO | Yes | There is no difference for remote UE to transmit discovery traffic or communication traffic in this case. |
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**Question 2-3: In case of sidelink discovery, for OOC remote UE which has not been connected to network via a relay UE, do companies agree only resource allocation mode 2 can be supported? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| OPPO | Yes |  |
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## Sidelink discovery and communication data multiplexing

In [2] and [4], the multiplexing issue of sidelink discovery and communication was discussed:

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| **Company** | **Proposals** |
| [R2-2107089](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2107089%20-%20Remaining%20issues%20on%20relay%20discovery.doc) | **Proposal 1: RAN2 confirm that discovery and data can’t be multiplexed in same TB in shared pool** |
| [R2-2107313](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2107313.docx) | Therefore, in the context of discovery message transmission, it implies that discovery message may not be multiplexed with data from non-discovery related LCHs within a MAC PDU.  **Proposal 4: The need of any additional discovery procedure specific LCP restrictions needs to be further discussed.** |

As indicated in R2-2107089 [2], the justifications of Proposal 1 are listed below:

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| First, transmissions with different cast-type can’t be multiplexed. Therefore, discovery at least can’t be multiplexed with unicast PC5 data. Secondly, RAN2 has agreed L2 ID design of discovery is up to SA2. Therefore, it may be different from L2 ID of broadcast transmission |

Hence, the following issues should be discussed:

**Question 3-1: Do companies agree that the sidelink discovery message and the sidelink communication data cannot be multiplexed into one MAC PDU in shared resource pool? Please give your comments.**

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| **Companies** | **Yes/No** | **Comments** |
| Qualcomm | Yes | Please note that it has been specified in TS 23.304 that L2 destination ID will be used:   |  | | --- | | **Copy from Clause 5.2.1.2 of TS 23.304:**  2) Parameters used for 5G ProSe Direct Discovery:  - The mapping of ProSe services (i.e. Application IDs) to Destination Layer-2 ID(s) for sending/receiving initial signaling of discovery messages.  NOTE 2: The same Destination Layer-2 ID for 5G ProSe Direct Discovery can be mapped to more than one ProSe services. |   Therefore, the discovery destination L2 ID is preconfigured. For data broadcast (typecal discovery cast-type), the destination L2 ID is configured and passed from higher layer which should be aware of the preconfigured destination L2 ID for discovery. Thus, we don’t think higher layer shares the L2 ID between discovery and communication. |
| OPPO | See comment | Here for “shared” resource pool, we understand it can be used for a UE to carry both communication and discovery traffic. Then whether both can be multiplexed into one MAC PDU depends on the L2 ID space.  If the L2 ID space for discovery and communication is separate, they cannot be multiplexed since so far SL-SCH MAC PDU only support LCH of the same L2 ID.  Else, it can be multiplexed into the same PDU.  We understand the L2 ID space separation is being discussed in SA2, so RAN2 can just wait for decision by SA2. |
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If the answer of Question 3-1 is yes, it should further discuss whether there is any enhancement is needed in LCP as discussed in [4]. The first step of LCP is destination selection, but currently, it is still unclear whether the discovery and communication can share the same L2 destination ID. If different L2 destination ID is used for discovery and communication, there is no need to enhance the LCP procedure; otherwise, it should clarify that the data from logical channel of sidelink discovery and data from logical channel of sidelink communication cannot be multiplexed. But how L2 destination ID is allocated depends SA2, considering SA2 is discussing this issue, we can wait until there is SA2 conclusion.

## BSR for sidelink discovery transmission

In this meeting, contributions [2], [5] and [6] discussed the BSR for sidelink discovery transmission. The corresponding proposals are as below:

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| **Company** | **Proposals** |
| [R2-2107089](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2107089%20-%20Remaining%20issues%20on%20relay%20discovery.doc) | **Proposal 4: For Mode 1 RA, no spec change on BSR is required. Instead, AMF to forward the discovery destination L2 ID to RAN via NGAP message, and gNB can differentiate whether the BSR is for discovery or SL data based on the SL destination ID in SL-BSR**  **Proposal 5: If Proposal 4 is agreed, RAN2 send LS to SA2 to request introducing the signaling** |
| [R2-2107212](file:///C:\Users\mtk16923\Documents\3GPP%20Meetings\202108%20-%20RAN2_115-e,%20Online\Extracts\R2-2107313.docx) | Proposal 5: A specific LCGID should be used to indicate the necessity of discovery message transmission when reporting SL-BSR MAC CE towards the network. |
| R2-2108143 | **Proposal 2: In order for the gNB to differentiate the buffer size of discovery message and other PC5 signalling, one new logical channel group should be set for SL-SRB4.** |

According to the current SR design, once gNB receives the SR, it cannot differentiate whether the received SR is for discovery message or sidelink communication data. In order to perform proper scheduling, the following enhancements can be considered:

* **Alt-1:** Enhance SL-BSR to differentiate buffer size for discovery and data traffic, by introduce a dedicated LCG for discovery message. [2][5][6]
* **Alt-2:** Allow AMF to forward the discovery destination L2 ID to RAN, so that gNB can differentiate based on the SL destination L2 ID in SL-BSR. [2]

For Alt-1, SA2 does not need to be involved, and RAN2 can solve the issue by RAN2 itself, but a new discovery-specific LCG ID should be defined.

For Alt-2, it should first make clear whether the L2 destination ID of sidelink discovery message and sidelink communication data can be shared? SA2 should be involved.

**Question 4-1: In case of mode 1 resource allocation for relay UE, in order to let gNB differentiate the buffer status of sidelink discovery message and sidelink communication, which option do companies prefer? Please give your comment.**

* **Option 1: Introduce discovery-specific LCG ID.**
* **Option 2: Using different L2 destination ID to identify the SL-BSR of discovery message.**
* **Option 3: Others (Please give the detailed description).**

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| **Companies** | **Option** | **Comments** |
| Qualcomm | Option 1 preferred | We think both Option 1 and Option 2 can work.  We slightly prefer Option 1 where the specific LCG ID can be either configured by RRC or fixed in Spec.  For Option 2, because gNB is not aware of discovery L2 destination ID, there is some extra signaling change. And it may need to invovle SA2. But we are also fine with Option 2 if majority prefer. |
| OPPO | Option 1, and option 2 dependent on SA2 conclusion | We assume this Q is related to the outcome of Q1-1, if options other than option-1 of that Q is selected, then there is a need for network to differentiate target resource for discovery.  Option-1 is feasible no matter whether L2 ID space for discovery and communication is overlapping. While option-2 relies on the validity of separated L2 ID space for discovery and communication.  So option-1 is a feasible way-out, and option-2 depends on the SA2 conclusion of L2 ID space separation, which is dependent on SA2 conclusion as replied to Q3-1. |
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# Conclusion

# References

1. R2-2106994 Leftover Issues for Sidelink Discovery CATT

1. [R2-2107089](file:///C:\\Users\\mtk16923\\Documents\\3GPP%20Meetings\\202108%20-%20RAN2_115-e,%20Online\\Extracts\\R2-2107089%20-%20Remaining%20issues%20on%20relay%20discovery.doc" \o "C:Usersmtk16923Documents3GPP Meetings202108 - RAN2_115-e, OnlineExtractsR2-2107089 - Remaining issues on relay discovery.doc) Remaining issues on relay discovery Qualcomm

1. [R2-2107313](file:///C:\\Users\\mtk16923\\Documents\\3GPP%20Meetings\\202108%20-%20RAN2_115-e,%20Online\\Extracts\\R2-2107313.docx" \o "C:Usersmtk16923Documents3GPP Meetings202108 - RAN2_115-e, OnlineExtractsR2-2107313.docx) Leftover aspects of Relay discovery Intel

1. [R2-2108152](file:///C:\\Users\\mtk16923\\Documents\\3GPP%20Meetings\\202108%20-%20RAN2_115-e,%20Online\\Extracts\\R2-2108152-Relay%20Discovery%20for%20stage%203.docx" \o "C:Usersmtk16923Documents3GPP Meetings202108 - RAN2_115-e, OnlineExtractsR2-2108152-Relay Discovery for stage 3.docx) Relay Discovery transmission for stage 3 LG
2. R2-2107212 Discussion on remaining issue of relay discovery OPPO
3. R2-2108143 Further discussion on Relay discovery ZTE, Sanechips