3GPP TSG-RAN WG2 #114-e Tdoc R2-210xxxx

**Electronic Meeting, May 19 – 27, 2021**

Agenda Item: 8.7.2

Source: OPPO

Title: Offline discussion xxx

Document for: Discussion, Decision

# Introduction

This report is targeting on the below offline discussion:

* [AT114-e][617][Relay] Open issues on discovery (OPPO)

      Scope: Handle open issues on relay discovery:

* Discuss P1a/P2a/P2b of R2-2106457
* Discuss the case of no network configuration available in P3a of R2-2106457 (preconfiguration vs. no discovery)
* Conclude on dedicated resource pool for discovery
  + If supported, consider if there is impact to resource allocation
* Discuss fixed vs. configurable priority of discovery messages
* Discuss whether to deprioritise discovery gaps in Rel-17

      Intended outcome: Report to CB session, in R2-2106586

      Deadline:  Tuesday 2021-05-25 1000 UTC (can extend if needed)

Also, please note that the offline discussion is based on the below agreement made:

Agreements:

Proposal 3b (modified): RAN2 confirm the SI conclusion that for L2 remote UE which is out-of-coverage, and is neither in RRC\_CONNECTED nor RRC\_IDLE/INACTIVE, it can rely on pre-configuration.

Proposal 4 (modified): RAN2 confirm the SI conclusion that for L3 remote UE which is out-of-coverage, and is neither in RRC\_CONNECTED nor RRC\_IDLE/INACTIVE, it should follow pre-configuration.

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.

Proposal 1b: RAN2 agree that for relay/remote UE in RRC IDLE/INACTIVE state, in-coverage on the serving frequency, and the serving frequency is not shared with concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency

- If there is Uu deployed at the concerned SL frequency, UE shall 1) rely on the discovery related SIB, if any broadcasted in the concerned SL frequency; Or 2) if there is no discovery related SIB on the concerned SL frequency, UE does not perform SL discovery transmission/reception on the concerned frequency.

- If there is no Uu deployed at the concerned frequency, UE shall rely on pre-configuration.

Proposal 1c: RAN2 agree that for relay/remote UE in RRC IDLE/INACTIVE state, in-coverage on the serving frequency，if the serving frequency is shared with concerned SL frequency

- If there is no discovery related SIB broadcasted on the serving carrier, UE does not perform SL discovery transmission/reception on the concerned frequency.

Proposal 6: RAN2 agrees to reuse Rel-16 power control mechanism for transmission of discovery messages.

Proposal 8: The same PDCP data PDU format as SL-SRB0 is used for sidelink discovery message (SL-SRB4), and the SDU type field is not used for SL-SRB4.

Proposal 9: RAN2 agrees to postpone the discussion related to resource allocation to after RAN#92-e. [FFS if impact from dedicated resource pool; to be revisited this meeting.]

Proposal 10: RAN2 to postpone the issue on network capability differentiation to stage 3 ASN.1 discussion.

Proposal 11: RAN2 rely on SA2 on the L2 ID design for discovery message. No LS is needed.

Proposal 13: De-prioritize additional condition for discovery transmission/reception in Rel-17.

# Discussion

## Discovery configuration

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| **Proposal 1a: RAN2 agree that for relay/remote UE in RRC IDLE/INACTIVE state, and in-coverage on the serving frequency:**   * **If there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency but the Tx resource pool configuration is absent, UE shall enter RRC CONNECTED state to acquire dedicated configuration on Tx resource pool.** |

The intention of proposal 1 is to address the scenario that for relay/remote UE in RRC IDLE/INACTIVE state and in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency and if the configuration of concerned SL frequency is included within the SIB of the serving frequency but the Tx resource pool configuration is absent, then UE shall enter RRC CONNECTED state to acquire dedicated configuration on Tx resource pool, which is the traditional UE behaviour from Rel-14 to Rel-16.

However, during the pre-meeting email discussion, one company raise the concern that LTE Prose mechanism shall also be considered as another alternative, that is, the UE can

* either enter RRC CONNECTED state to acquire dedicated configuration,
* or read SIB from concerned SL frequency as per network indication in the SIB.
* Or prohibited from transmission directly

Therefore, companies are encouraged to provide the view on which alternative to go for this scenario.

**Q1**: For relay/remote UE which are RRC IDLE/INACTIVE state and in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency but the Tx resource pool configuration is absent, then what is the corresponding UE behaviour?

* Alt 1: there is only one UE behavior, i.e., UE will enter RRC CONNECTED state to acquire dedicated configuration on Tx resource pool
* Alt 2: besides the behavior of “UE will enter RRC CONNECTED state to acquire dedicated configuration on Tx resource pool”, there could be other UE behavior, e.g.,, 1) UE read SIBs on the concerned SL frequency as per network indication in the SIB; 2) Or prohibited from transmission directly, based on explicit indicator in SIB. (if this option is selected, please indicate what are the other UE behavior that should be allowed in this case), and which option the UE should adopted will follow the explicit indicator that is to be included in SIB.

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| Company | Option | Comment |
| OPPO | Alt 1 | The mechanism described in alt-1 has been applied from Rel-14 to Rel-16. Thus, considering there is no big different on the scenario of Rel-17 NR sidelink relay, it is suggested to reuse the mechanism. |
| Qualcomm | Alt 1 | Alt-2 is LTE Rel-12/13 solution but was not included in LTE Rel-14/15 and NR Rel-16. We prefer a simple UE behaviour on top of NR Rel-16 V2X (i.e. Alt-1) so that most implementation in NR Rel-16 can be reused for sidelink relay. |
| InterDigital | Alt 1 |  |
| MediaTek | Alt 1 | We prefer Alt 1 to have less implementation complexity. And we share same view from Qualcomm. |

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| **Proposal 2a: RAN2 agree that RRC\_CONNECTED relay/remote UE which are in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency, it can only use the SL discovery Tx resource configuration provided by dedicated signalling if provided, or not transmit discovery if it is not provided.** |

The intention of proposal 2a is to address the scenario that when relay/remote UE is under RRC\_CONNECTED state and in-coverage on the serving frequency, also the network is capable of relay service, in that case the UE shall perform relay discovery as per dedicated SL discovery Tx resource configuration from network if provided, otherwise, not transmit discovery. Since at the very late stage during the pre-meeting email discussion, some descriptive wording is added to differentiate the scenario between proposal 2a and 2b, rapporteur suggest companies to further check if proposal 2a can be supportive.

**Q2**: For relay/remote UE which are RRC\_CONNECTED state and in-coverage on the serving frequency, if there is discovery related SIB broadcasted on the serving frequency, and if the configuration of concerned SL frequency is included within the SIB of the serving frequency, does company agree that the UE can only use the SL discovery Tx resource configuration provided by dedicated signalling if provided, or not transmit discovery if it is not provided?

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes |  |
| Qualcomm | Yes | We understand it was agreed in LTE discovery due to political reason. Although we don’t see issue for UE to use configuration in SIB if dedicated signalling is not provided, we can accept to use LTE baseline. |
| InterDigital | Yes | The UE should follow dedicated signaling. |
| MediaTek | Yes |  |

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| **Proposal 2b: RAN2 agree that RRC\_CONNECTED L3 relay/remote UE which are in-coverage on the serving frequency, and the serving frequency is not shared with concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency, follow the behaviour for RRC IDLE/INACTIVE in this case (i.e., P1b).** |

The intention of proposal 2b is to address the scenario that for RRC\_CONNECTED L3 relay/remote UE which are in-coverage on the serving frequency, and the serving frequency is not shared with concerned frequency, on the other hand, network is not capable of relay, in that case, there could be one step further, i.e.

* If there is Uu deployed on the concerned SL frequency, the UE shall either relay on the discovery related SIB from concerned SL frequency if broadcasted, otherwise the UE does not perform SL discovery on the concerned SL frequency.
* Or if there is no Uu deployed on the concerned SL frequency, the UE shall rely on pre-configuration.

Since the case was previously missing in the summary report and added at a late stage during pre-meeting email discussion, rapporteur encourages companies to have some time to further check the intention of the proposal.

**Q3a**: For L3 relay/remote UE which are RRC\_CONNECTED state and in-coverage on the serving frequency, and the serving frequency is not shared with the concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency, and if there is Uu deployed at the concerned SL frequency, does company agree that the UE shall:

1. Rely on the discovery related SIB, if any, broadcasted in the concerned SL frequency
2. If there is no discovery related SIB on the concerned SL frequency, UE does not perform SL discovery transmission/reception on the concerned frequency

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| MediaTek | Yes |  |

**Q3b**: For L3 relay/remote UE which are RRC\_CONNECTED state and in-coverage on the serving frequency and the serving frequency is not shared with the concerned frequency, if the configuration of concerned SL frequency is absent within the SIB of the serving frequency or if there is no discovery related SIB on the serving frequency, and if there is no Uu deployed at the concerned SL frequency, does company agree that the UE shall rely on pre-configuration?

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes |  |
| Qualcomm | Yes |  |
| InterDigital | Yes |  |
| MediaTek | Yes |  |

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| **Agreement:**  **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.** |

During the online session, the L2 remote UE, which is out-of-coverage, but connected to network via a relay UE, its behaviour is defined clearly when network provide the discovery configuration. But one left issue is when network does not provide configuration, what is the exact UE behaviour. Basically, there are two major solutions for this issue,

* some companies thought remote UE can use pre-configuration to perform discovery;
* others thought remote UE in this case cannot perform discovery.

Rapporteur suggests to further discuss based on these two alternatives.

**Q4**: In the case 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), what is the remote UE behaviour when network configuration, i.e., SIB or dedicated signalling, is not available?

Alt 1: Remote UE shall rely on pre-configuration to perform discovery.

Alt 2: Remote UE shall not perform discovery.

Alt 3: Others (if this option is selected, please clarify the detailed behaviour)

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| Company | Option | Comment |
| OPPO | Alt1 |  |
| Qualcomm | Alt1 | This is a case different from LTE. We think RAN2 should be careful. For example, for a OOC remote UE in CONNECTED state, if PC5 RLF is detected by remote UE, we are not sure whether it is regarded as CONNECTED because its UE context is still maintained in gNB. If we don’t allow it to use pre-configuration, this OOC remote UE can’t trigger discovery any more. |
| InterDigital | Alt2 | For a remote UE in RRC\_CONNECTED, it should follow NW configuration, regardless if it is OOC (it is still under NW control). |
| MediaTek | Alt1 |  |

## Discovery resource pool configuration

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| **Proposal 5: RAN2 discuss whether to support dedicated discovery resource pool besides shared resource pool configuration.** |

During last meeting, it has already agreed that shared resource pool configuration for sidelink discovery will be the baseline solution. In this meeting, quite a lot of companies raised that dedicated discovery resource pool configuration shall also be supported. Besides, during online session, a round of showing hand had been performed and it seems that majority companies support to have dedicated resource pool.

Show of hands: (1) support dedicated resource pool for discovery, (2) common pool only.

1. 13 hands
2. 6 hands

Before going into the final decision on whether to support dedicated resource pool or not, some resulted detailed issue from supporting dedicated resource pool needs to be checked.

Firstly, during the online discussion, Apple raised the issue that UE behavior on resource pool usage should also be clarified if dedicated resource pool is configured. Rapporteur considers that it is a nature principle UE should only use dedicated discovery resource pool, if configured by network, otherwise, UE should use shared resource pool.

**Q5**: Assuming R17 spec support dedicated resource pool, do you agree that UE should

* Either only use dedicated discovery resource pool, if configured by network.
* Or, otherwise, i.e., if dedicated discovery resource pool is not configured, UE should only use shared resource pool.

So, there is no case where both dedicated and shared resource pool are available for a UE.

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes | To simplify the UE behaviour and minimize spec impact, we think it is the optimized way to go. |
| Qualcomm | Yes | If Network configures dedicated discovery for a UE, it means Network reserves resource only for discovery. So, UE should only use dedicated resource pool. We don’t see benefit to configure both dedicated pool and shared pool simultaneously for one UE.  In addition, we assume a main use case of dedicated pool is for public safety UE which is only interested in non-relay discovery message other than data. This simple solution is sufficient |
| InterDigital |  | If we agree to such limitation, there seems to be not much advantage of supporting both shared and dedicated pools, and so it may be preferrable to simply rely on shared pool design only. |
| MediaTek | Yes | Agree with OPPO. |

Secondly, there is a left issue in P9.

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| **Agreement:**  **Proposal 9: RAN2 agrees to postpone the discussion related to resource allocation to after RAN#92-e. [FFS if impact from dedicated resource pool; to be revisited this meeting.]** |

During online session, Interdigital raised the concern that there may be some potential impact caused if dedicated resource pool is configured. By reading the paper in R2-2104869, rapporteur understand the related proposal is as follows

Proposal 1: Restrictions on resource selection by the UE are introduced to ensure frequency diversity by a mode 2 UE.

Proposal 2: Data from the discovery LCH is mapped to a grant which satisfies the frequency diversity requirement for discovery.

Yet from rapporteur perspective, given the limited time on objective-1 in the WID, this kind of discovery specific optimization has to be down-prioritized in this release.

**Q6**: Assuming R17 spec support dedicated resource pool, do you agree to down-prioritize discovery-specific resource allocation optimization in this release?

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes |  |
| Qualcomm | Yes | First, we don’t think Proposal 1 and 2 in R2-2104869 are for dedicated pool. They were proposed for shared pool according to InterDigital’s old submission R2-2100522:  Proposal 7: *For the shared pool scenario, resource selection rules for the retransmission resource are used to ensure frequency diversity by a mode 2 UE. Details can be discussed in the WI phase.*  Secondly, we think it is majority view that for dedicated pool, PHY layer parameters and design will reuse the R16 legacy resource pool design. As far as we see, no specific RAN1 impacts are identified by companies, and no company proposal to enhance dedicated pool in this meeting. |
| InterDigital |  | We think it is too early to rule out any resource allocation aspects. This is not limited to only proposal 7 pointed out by Qualcomm but also:   * Whether discovery and data can be transmitted in the same TB in the shared pool scenario? * Whether discovery pool is overlapped with data pool? * ….   By agreeing to Q6, are we saying that RAN2 does not need to answer these questions? Our intention is we prefer to complete discussion on discovery design before we can make such generic conclusions that resource allocation in general (both discovery and data) has no impacts.  We would be ok to keep the original wording of the proposal (and remove the FFS). In any event, this was already agreed online, and so we think there is no need to further discuss this proposal (apart from removing the FFS). |
| MediaTek | Yes |  |

Finally, on the support of dedicated resource pool: if start from the standpoint of majority view, i.e., support dedicated resource pool, and with the understanding that the final decision is anyway to be done in the online discussion, rapporteur would like to use this email discuss to seek for possible compromise wording to reach consensus. Otherwise, if we finally fail to reach consensus on a WF, rapporteur understands we need to down-prioritize dedicated pool in this release due to lack of time.

So, we can start from way-forward wording as follows to collect companies’ view on it.

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| **WF: Dedicated discovery resource pool is allowed besides shared resource pool configuration, whether it is configured is based on network implementation.** |

**Q7**: Do you agree with the WF as above?

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| Company | Option (Yes/No) | Comment |
| OPPO |  | If RAN2 can close the open issues in Q5 and Q6 quickly, i.e.,  - For Q5, if the majority view is yes  - For Q6, if the majority view is yes  OPPO would support the WF. Otherwise, we tend to down-prioritize the support of dedicated resource pool in this release, in order to meet the required deadline of objective-1 in the WID. |
| Qualcomm | Yes | To address OPPO’s concern, we have below wording suggestion:  **WF: Dedicated discovery resource pool is allowed besides shared resource pool configuration, whether it is configured is based on network implementation. The UE can only use dedicated discovery resource pool, if configured by network. RAN2 assume PHY layer parameters and design will reuse the R16 legacy resource pool design.**  Again, since both shared and dedicated pool were agreed to support in SI phase, we don’t think it can be regarded as optimization. Otherwise, why RAN2 can agree it in SI phase? Generally, RAN2 only revert SI conclusion when big technique issue is identified. However, we don’t even see any technique issue of dedicated pool was raised by companies. If limited TU is real concern, isn’t agreed P9 indicated RAN2 will study enhancement for shared pool after RAN#92? So, we don’t understand why RAN2 need to discuss dedicated pool to be precluded in WI. |
| InterDigital | Yes | We are fine with the proposed WF. |
| MediaTek | Yes | We understand that dedicated discovery resource pool and shared resource pool configuration both have their own pros and cons. So, the WF proposed by the rapporteur (i.e. up to network implementation) is already a compromised way to go. |

## Configure the priority of sidelink discovery message

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| **Proposal 7: RAN2 discuss on how to configure the priority of sidelink discovery message.** |

During last meeting, it has already agreed that one new SL-SRB4 is used for all discovery messages and its parameters will be fixed except the LCH priority. Therefore, in this meeting, quite a lot of companies providing their views on this issue. Generally speaking, there are two major views providing from each camp, that is either fix the LCH priority as other SL-SRBs or network configures the LCH priority. Thus, rapporteur suggests to involve more companies to provide their views on the issue.

**Q8**: How to configure the priority of sidelink discovery message?

* Alt 1: fix the priority value in specification (if this option is selected, please indicate the preferred value of priority)
* Alt 2: Network configure the priority value

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| Company | Option | Comment |
| OPPO | Alt 1 | There is no big issue to reuse the specified priority as other SL-SRBs. Considering limited time for closing objective 1. Therefore it is preferred to follow legacy principle. |
| Qualcomm | See comments | Although we see benefit of configurable priority value for discovery, we can compromise to use fixed priority to close this issue. |
| InterDigital | Alt2 | NW controlling the priority seems more flexible without adding significant complexity. |
| MediaTek | Alt 1 | For simplicity, we prefer fixed priority value, e.g. LCH priority 0 (the highest priority). |

## Configuration of discovery gaps

A few companies raise the issue on whether to adopt discovery gap in Rel-17. In LTE, sidelink discovery gap was introduced to handle limited UE capability on Tx/Rx chain. For NR, as observed, it is anyway infeasible for shared resource pool which has been agreed already, regardless whether dedicated resource pool can be agreed or not. So, rapporteur would like to check companies’ view on whether to introduce discovery gaps if dedicated resource pool is configured.

**Q9**: Do you agree to down-prioritize the support of discovery gaps in this release?

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| Company | Option (Yes/No) | Comment |
| OPPO | Yes |  |
| Qualcomm | No strong view |  |
| InterDigital | Yes |  |
| MediaTek | Yes |  |

# Conclusion

The summarized proposals are given below:

# References

[1] R2-2104736 Remaining issues on relay discovery Qualcomm Incorporated

[2] R2-2104746 Leftover Issues on Sidelink Discovery CATT

[3] R2-2104869 Discovery Procedure for sidelink relay InterDigital

[4] R2-2104892 Discussion on remaining issues of NR sidelink relay discovery OPPO

[5] R2-2104958 Remaining issues on Relay discovery procedure vivo

[6] R2-2104976 Discussion on Relay discovery in Sidelink Relay ZTE, Sanechips

[7] R2-2105022 Open aspects on relay discovery Intel Corporation

[8] R2-2105342 Remaining issues for SL relay discovery Samsung

[9] R2-2105390 Discovery resources for sidelink relaying Kyocera

[10] R2-2105491 Left issues for SL discovery Ericsson

[11] R2-2105535 Discussion on Ralay discovery Spreadtrum Communications

[12] R2-2105740 Remaining issues on discovery for sidelink relay Huawei, HiSilicon

[13] R2-2105742 Use of Pre-configuration and collocated neighbour cell carrier Xiaomi Mobile Software

[14] R2-2105807 Relay Discovery for L2 and L3 relay Lenovo, Motorola Mobility

[15] R2-2106266 Left issues for relay discovery message transmission LG Electronics Inc.

[16] R2-2106435 Consideration on remaining issues of NR sidelink relay discovery China Telecom

[17] R2-2106437 Remaining issues on Relay Discovery MediaTek Inc.