3GPP TSG-RAN WG2 Meeting #116-e R2-2111255

Electronic, 1st - 12th Nov, 2021

Source: CATT

Title: [Draft] Summary of AI 8.7.3.1

Agenda Item: 8.7.3.1

Document for: Discussion and Decision

# Introduction

This contribution is to summarize the contributions from agenda item 8.7.3.1 on sidelink discovery excluding the below two aspects:

1. The proposals related to the post email discussion of [Post115-e][611][Relay] Discovery shared and dedicated pool issue;
2. The proposals related to non-relay discovery.

# Discussion

## High priority issues

### Multiplexing of sidelink discovery and sidelink communication data

In this meeting, the following contributions mentioned the issue of whether multiplexing of sidelink discovery and sidelink communication data is allowed or not in the shared resource pool:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 1: RAN2 confirm that discovery and data can’t be multiplexed in same TB in shared pool. |
| R2-2109857 | ZTE | Proposal 7: Since the L2 destination ID for discovery message may be the same as the L2 group ID or source UE’s L2 ID, the groupcast/unicast discovery message may be multiplexed with sidelink communication packet with same L2 destination ID if shared resource pool is used. |
| R2-2110271 | MediaTek | Proposal 3: RAN2 confirms that discovery message and data (regardless of the same or different cast types) cannot be multiplexed together into the same MAC PDU. |

According to the above proposals, regarding to the issue of whether sidelink discovery messages and sidelink communication data can be multiplexed in one MAC PDU in shared pool, two companies suggested no, one company suggested yes.

Note that SA2 has agreed that the L2 destination L2 ID used for sidelink discovery is different from the destination L2 ID used for SL communication, as described in clause 5.1.2.1 of TS 23.304:

NOTE 3: The values provisioned for the Destination Layer-2 ID(s) for 5G ProSe Direct Discovery are different to the values provisioned for Destination Layer-2 ID(s) for 5G ProSe Direct Communication, defined in clause 5.1.3.1.

Hence, according to the rapporteur’s understanding, since different destination L2 IDs are used for sidelink discovery and sidelink communication, hence it is obvious that they can’t be multiplexed into the same MAC PDU no matter shared or dedicated resource pool is used. Considering some companies raised concern of different understanding for the above SA2’s conclusion. Rapp output the below proposal.

**Proposal 1: RAN2 to discuss whether sidelink discovery and sidelink communication data can be multiplexed into one MAC PDU.**

### How does the network identify the buffer size for discovery?

In this meeting, the following contributions mentioned the issue of how to identify the BSR for discovery:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 3: For Mode 1 RA, the UE reports destination L2 ID of discovery to gNB via SUI, so that gNB can differentiate dedicated buffer size for discovery message based on the destination L2 ID included in MAC-CE of SL-BSR. |
| R2-2109857 | ZTE | Proposal 4: In order for the gNB to differentiate the buffer size of discovery message and other PC5 signalling, it is suggested to set one dedicated logical channel group ID for SL-SRB4. |
| R2-2110218 | vivo | Proposal 3: No new LCG ID is introduced to distinguish discovery message from communication data in SL BSR report.  Proposal 4: In case the same L2 ID is used for communication data and discovery message transmission, this L2 ID can be assigned with two different destination indexes respectively for communication data and discovery message by the UE. |
| R2-2110500 | OPPO | Proposal 1: UE reports its interest in discovery transmission/reception towards the network via SUI message.  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. |
| R2-2110271 | MediaTek | Proposal 4: A SL logical channel is associated with discovery messages in one of the following ways:   * A SL logical channel is associated with discovery messasge by an explicit indicator in RRC IE. * A SL logical channel is associated with a discovery message specific L2 desitnation ID. |
| R2-2110489 | Huawei | Proposal 3: UE shall inform gNB whether the destination ID is for discovery message transmission in SidelinkUEInformation message. |

According to the above contributions, 2 companies [1][12] suggested that UE should report the destination L2 ID of discovery to network using SUI in order to let the gNB to identify the dedicated buffer size for sidelink discovery. 2 companies [4] [13] suggested to introduce dedicated LCG ID for sidelink discovery.

In addition, as discussed in contribution [1], when discovery message is transmitted using mode 1 resource allocation, the gNB should assign SL grant for discovery payload only. However, gNB can’t differentiate whether the received SR is for discovery message or data traffic, and it also doesn’t know the dedicated buffer size for discovery message. Spec change is required to fill the gap.

**Proposal 3: UE should report the destination L2 ID of discovery to gNB via SUI, which is used for gNB to associate between destination L2 ID and reported SL-BSR in case of mode-1 resource allocation.**

### For sidelink discovery, how to design and use the exceptional pool?

In this meeting, the following contributions discussed the exceptional pool for sidelink discovery:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 4: Exceptional pool specified in Rel-16 can be used to transmit discovery under the same conditions defined in Rel-16. And there is no need to introduce dedicated exceptional pool only for discovery. |
| R2-2110500 | OPPO | Proposal 2: When the UE is configured with mode 1 resource allocation scheme, it can use the exceptional resource pool to transmit discovery message when T301, T304, T310 or T311 is running.  Proposal 3: When the UE is configured with mode 2 resource allocation scheme, it can use the exceptional resource pool to transmit discovery message when there is no available sensing result in dedicated discovery resource pool or shared resource pool.  Proposal 4: The dedicated discovery exceptional resource pool is not needed. |

According to the above contribution, both of the two contributions suggest that no dedicated discovery exceptional resource pool is needed.

**Proposal 4: The discovery dedicated exceptional resource pool is not introduced.**

Furthermore, the conditions for using the exceptional resource pool for sidelink discovery should be further discussed. Both of the above two contributions suggested to follow the legacy Rel-16 mechanism.

**Proposal 5: The exceptional pool usage condition for discovery can follow the legacy Rel-16 mechanism, i.e., UE can use the exceptional resource pool to transmit discovery message when T301, T304, T310 or T311 is running for mode 1, or when there is no available sensing result for mode 2.**

### How to carry the sidelink discovery/relay configuration in SIB?

In this meeting, there are four contributions mentioned how to provide the sidelink discovery configuration in SIB, the corresponding proposals are listed below:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 5: A new NR SIB is introduced for discovery and relay configuration. |
| R2-2109903 | Ericsson | Proposal 5: The gNB signals the discovery IE in the SIB12. |
| R2-2110489 | Huawei | Proposal 7: Reuse SIB12 to include discovery related configuration. |
| R2-2110500 | Oppo | Proposal 10:Reuse SIB12 to carry relay/discovery related configuration. |

According to the above contributions, one company suggests to introduce new NR SIB for discovery and relay configuration, while the other three companies suggest reusing the legacy SIB12. Since the SIB fragmentation mechanism has already been applied to SIB 12, therefore, the size of SIB12 is not a big issue. In addition, there are quite lot of configurations for NR V2X shall be reused for NR sidelink relay.

**Proposal 6: Reuse SIB12 to carry the relay/discovery related configuration.**

### How to indicate the gNB capability on sidelink relay?

In this meeting, there are two contributions mentioned how to indicate the gNB capability on sidelink relay, the corresponding proposals are listed below:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 7: Introduce one explicit bit in new NR SIB to indicate whether the gNB supports L2 relay  Proposal 8: It is not necessary to introduce an explicit bit in NR SIB on the supporting of L3 relay because L3 relay operation is transparent to RAN. |
| R2-2109903 | Ericsson | Proposal 10: Introduce an indicator in the SIB indicating relay type independent of the discovery configuration IE. |

Both of the two contributions suggests to introduce an explicit indication in NR SIB to indicate whether the gNB supports relay, but the divergence is that whether it is necessary to identify the supported relay type. In [1], it suggested only one bit to indicate whether gNB supports L2 relay is enough, it is unnecessary to indicate whether L3 relay is supported or not since L3 relay operation is transparent to RAN; while in [5], it is said both relay type should be indicated in NR SIB.

**Proposal 7: Introduce explicit indication in NR SIB to indicate whether the gNB supports L2 relay. FFS for L3 relay and FFS on the detailed signaling design.**

### Detailed design on SL-SRB4

#### RLC mode of SL-SRB4

RAN2 has agreed that SL-SRB4 will be used for sidelink discovery, but there is still no agreement on which RLC mode should be adopted for SL-SRB4, one contribution mentioned this in this meeting:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109512 | CATT | Proposal 1: RLC UM mode is used for SL-SRB4. |

Although only one company raise this issue, from rapporteur’s perspective, it is necessary to clarify the RLC mode for SL-SRB4. Since In RAN2#115-e meeting [Offline-608][Relay], All 17 companies support RLC UM should be used for discovery messages. Rapporteur thinks it can be easy to reach the agreement for it.

**Proposal 8: RLC UM mode is used for SL-SRB4.**

#### Cast type of SL-SRB4

In this meeting, one companies proposed to establish multiple SL-SRB4 for sidelink discovery messages in order to support different cast types.

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109857 | ZTE | Proposal 6: To support the sidelink discovery messages with different cast types, multiple SL-SRB4 may be established corresponding to different L2 destination ID. |

Some company raised that SL-SRB4 is for a particular L2 destination ID. If there is a new L2 destination ID, it is a new PC5 link, instead of different SRBs for the same link. Hence, it is suggested to postpone the discussion. The proponent raised that at least unicast and broadcast should be considered for U2N relay discovery according to the description in TS 23.304. It is worthwhile to identify if there is any issue in RAN to support these two cast types. Hence, rapporteur output the below proposal:

**Proposal 9: RAN2 to discuss whether there is any issue in RAN to support unicast and broadcast for SL-SRB4.**

#### HARQ feedback mechanism for SL-SRB4

In this meeting, two contributions mentioned the HARQ feedback for sidelink discovery message:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109857 | ZTE | Proposal 8: RAN2 to discuss if the HARQ feedback should be enabled for the groupcast and unicast based discovery message transmission. |
| R2-2110500 | OPPO | Proposal 9: It is suggested to disable HARQ feedback for SL-SRB4 for groupcast discovery message and discovery response message in model B discovery. |

Since it is related to which cast type is used for sidelink discovery in AS which is corresponding to Proposal 9. Hence, it is suggested to postpone the discussion.

#### Discovery range for SL-SRB4

In this meeting, three companies mentioned how to support the range for sidelink discovery:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109857 | ZTE | Proposal 5: The legacy LTE discovery range or NR SL transmission range support can be used as baseline for the 5G ProSe Direct discovery range. |
| R2-2100749 | Xiaomi | Proposal 1: RAN2 should agree that the 5GS ProSe Discovery Range is a basic functionality within scope for consideration by RAN2 under the current WID [2] |
| R2-2110218 | vivo | Proposal 5: LTE mechanism of range class is reused in NR that, the transmit power of discovery message should be determined with considering the requirement of Authorised discovery range provided by upper layer.  Proposal 6: If proposal 5 is agreed, send an LS to inform SA2.  Proposal 7: If proposal 5 is agreed, the power for a discovery message transmission should be determined with further considering the impacts brought by range classes.  Proposal 8: If proposal 5/7 is agreed, send an LS to inform RAN1. |

The key issue is that range in LTE is used for power control but range in NR is instead used for HARQ of groupcast. So, our understanding on key issue is whether NR can re-define range for power control as LTE in such late stage, which anyway should be a RAN2 decision.

**Proposal 10: RAN2 to discuss whether to support the range requirement for sidelink discovery.**

#### PDCP/RLC entity maintenance

Two companies proposed to discuss the PDCP layer aspects for SL discovery:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109512 | CATT | Proposal 13: For sidelink discovery, if transmission of PC5 discovery message for a specific destination is requested by upper layers, establish the corresponding PDCP/RLC entity for PC5 discovery message. |
| R2-2110452 | Samsung | Proposal 1. A PDCP entity establishment for a SLRB of sidelink discovery is requested by upper layer. |

Both of the two contributions suggest that the Tx PDCP entity establishment should be based on upper layer request, e.g., based on RRC request. If it is triggered by RRC request, the legacy PDCP entity establishment/release mechanisms for NR sidelink communication can be reused for discovery with the modification that the PC5-S signaling from upper layer should be changed to PC5-discovery signaling from upper layer.

**Proposal 11: The transmitting PDCP/RLC entity establishment for SL-SRB4 is requested by upper layer, e.g., if the transmission of PC5 discovery message for a specific destination is requested by upper layers, establish the corresponding PDCP/RLC entity for PC5 discovery message.**

Beside the PDCP entity establishment, [11] further discussed the PDCP entity re-establishment, release and other detailed design for PDCP layer, they proposed that:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2110452 | Samsung | Proposal 2. A PDCP entity re-establishment for a SLRB of sidelink discovery is not supported.  Proposal 3. The PDCP entity release for a SLRB of sidelink discovery can be requested by the upper layers.  Proposal 4. The transmit operation in subclause 5.2.3 of TS 38.323[1] and the receive operation in subclause 5.2.4 of TS 38.323[1] can be reused for a SLRB of sidelink discovery message.  Proposal 5. The initial value of TX\_NEXT is set to 0 for sidelink discovery.  Proposal 6. The same principle for RX\_NEXT and RX\_DELIV in NR sidelink communication for broadcast and groupcast can be applied to sidelink discovery.  Proposal 7. PDCP reordering and in-order delivery is supported for sidelink discovery.  Proposal 8. For sidelink discovery, t-Reordering timer can be determined by receiving UE implementation. |

**Proposal 12: PDCP entity re-establishment for SL-SRB4 is not supported.**

**Proposal 13: The PDCP entity release for a SLRB of sidelink discovery can be requested by the upper layers.**

**Proposal 14: The transmit operation in subclause 5.2.3 of TS 38.323[1] and the receive operation in subclause 5.2.4 of TS 38.323[1] can be reused for a SLRB of sidelink discovery message.**

**Proposal 15: The initial value of TX\_NEXT is set to 0 for sidelink discovery.**

**Proposal 16: The same principle for RX\_NEXT and RX\_DELIV in NR sidelink communication for broadcast and groupcast can be applied to sidelink discovery.**

**Proposal 17: PDCP reordering and in-order delivery is supported for sidelink discovery.**

**Proposal 18: For sidelink discovery, t-Reordering timer can be determined by receiving UE implementation.**

### Interaction with upper layer

Regarding to the AS/upper layer interaction, one contribution mentioned that:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109512 | CATT | Proposal 12: When receiving discovery message via SL-SRB4, UE shall pass discovery message to the higher layer along with an indication to indicate that the message is for 5G ProSe direct discovery. |

In CT1#132-e meeting, one note was agreed for 5G ProSe direct discovery procedure as following:

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| TS 24.554  NOTE x: The UE can determine the received PROSE PC5 DISCOVERY message for direct discovery solicitation is for 5G ProSe direct discovery based on an indication from the lower layer. |

According to the note, the AS layer of Rx UE should send the received discovery messages along with an indication to high layer to indicate that the message is 5G ProSe direct discovery. But considering there is different understanding for CT1’s note in RAN2, it is suggested to postpone the discussion.

## Low priority issues

Besides the issues mentioned in section 2.1, there are some other remaining issue which can be deprioritized in this meeting, listed below:

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| **Toc#** | **Source** | **Related proposals** |
| R2-2109431 | Qualcomm | Proposal 2: Because SA2 has agreed SL communication and discovery don’t share the same destination L2 ID, RAN2 confirm that there is no need to introduce a new LCP restriction for dedicated pool.  [Rapp-comment]: No spec impact. |
| R2-2110304 | Lenovo, Motorola Mobility | Proposal 2: The remote UE should perform discovery procedure after the remote UE receives release request from relay UE due to Uu RLF or HO in the L2/L3 relay case.  Proposal 3: The remote UE performs the discovery procedure when the remote UE declares the sidelink RLF in the L2/L3 relay case.  Proposal 4: The discovery configuration from network can be used if the remote UE has the discovery configuration from network. Otherwise, the pre-configured discovery configuation can be used in the following three cases.   * Case 1: The remote UE receives the release request from the relay UE due to RLF on Uu link. * Case 2: The remote UE receives releas request from the relay UE due to the recepion of handover command. * Case 3: The remote UE detects RLF on sidelink between the remote UE and relay UE.   [Rapp-comment]: These conditions are same as the relay reselection trigger conditions, hence these issues does not need to re-discuss again. |
| R2-2110218 | vivo | Proposal 9: For shared pool, current SL-CBR-PriorityTxConfigList is applied to sidelink discovery message transmission with UE always setting the Priority to 1.  Proposal 10: For dedicated pool for discovery, RAN2 to discuss whether/how PSSCH transmission parameters should be adjusted due to different CBR, considering following options:  - Option-1: use current SL-CBR-PriorityTxConfigList as in Proposal 9.  - Option-2: use current SL-CBR-CommonTxConfigList (i.e. w/o Priority configuration)  [Rapp-comment]: Rapp understands it is quite related to shared/dedicated pool discussed in [Post115-e][611][Relay], and the discussion on it can be postponed. |
| R2-2110489 | Huawei | Proposal 4: UE shall inform gNB the SL configuration grant is requested for sidelink discovery transmission in UEAssistanceInformation without reporting QoS related information.  [Rapp-comment]: Rapp understands it needs be discussed after the following issues are clear:   * Whether configure grant can be supported for sidelink discovery? * Whether gNB configures SL configured grant for discovery depending on the assistance info from the UE? |
| R2-2109431 | Qualcomm | Proposal 6: On how the UE can determine whether the gNB is “discovery not capable” or “discovery capable but not provided in SIB”, UE can check the scheduling bit in NR SIB1  [Rapp-comment]: Rapp understands it is quite related to non-relay discovery. We can come back to discuss this issue after non-relay discussion. |
| R2-2109903 | Ericsson | [Proposal 6 Indicators on whether the gNB supports relay discovery and/or non-relay discovery are signaled in the SIB (e.g., SIB12) independent of the discovery configuration IE.](#_Toc85717767)  [Proposal 7 If there is no discovery configuration IE in the SIB, but there is an indicator indicating that the gNB supports relay discovery in the SIB, then the UE determines that the gNB supports relay operation, but the gNB does not provide discovery configuration.](#_Toc85717768)  [Proposal 8 If there is no discovery configuration IE in the SIB, but there is an indicator indicating that the gNB supports non-relay discovery in the SIB, then the UE determines that the gNB supports non-relay discovery, but the gNB does not provide discovery configuration.](#_Toc85717769)  [Proposal 9 If there is no discovery configuration IE in the SIB, and there is no indicator indicating that the gNB supports relay discovery or non-relay discovery in the SIB, then the UE determines that the gNB doesn’t support discovery.](#_Toc85717770)  [Rapp-comment]: Rapp understands it is quite related to non-relay discovery. We can come back to discuss this issue after non-relay discussion. |
| R2-2109960 | Intel | Proposal 2: Inform SA2 to include the L2 Relaying Additional AS criteria i.e. PLMN ID and cell ID within the discovery message announcer and discoveree information to support L2 relay (re-)selection.  [Rapp-comment]: How to include the PLMN ID and cell ID should be discussed in SA2. |
| R2-2110304 | Lenovo, Motorola Mobility | Proposal 1: A Discovery message from L2 U2N relay contains:   * at least one of the IE systemInformationAreaID; or, a BITMAP indicating which SIBs or which features are supported by the relay UE’s serving cell; and * the first PLMN Id appearing in the SIB1 of the serving cell.   [Rapp-comment]: How to include the PLMN ID and cell ID should be discussed in SA2. Regarding to the systemInformationAreaID, since RAN2 have already agreed that other additional AS criteria are not considered in this release in RAN2#113bis, hence it does not need to be further discussed. |

# Conclusion

Based on the discussions in section 2, the following proposals have been derived:

**Easy agreements:**

**Proposal 4: The discovery dedicated exceptional resource pool is not introduced.**

**Proposal 5: The exceptional pool usage condition for discovery can follow the legacy Rel-16 mechanism, i.e., UE can use the exceptional resource pool to transmit discovery message when T301, T304, T310 or T311 is running for mode 1, or when there is no available sensing result for mode 2.**

**Proposal 8: RLC UM mode is used for SL-SRB4.**

**Proposal 11: The transmitting PDCP/RLC entity establishment for SL-SRB4 is requested by upper layer, e.g., if the transmission of PC5 discovery message for a specific destination is requested by upper layers, establish the corresponding PDCP/RLC entity for PC5 discovery message.**

**Proposal 12: PDCP entity re-establishment for SL-SRB4 is not supported.**

**Proposal 13: The PDCP entity release for a SLRB of sidelink discovery can be requested by the upper layers.**

**Proposals can be further discussed:**

**Proposal 1: RAN2 to discuss whether sidelink discovery and sidelink communication data can be multiplexed into one MAC PDU.**

**Proposal 3: UE should report the destination L2 ID of discovery to gNB via SUI, which is used for gNB to associate between destination L2 ID and reported SL-BSR in case of mode-1 resource allocation.**

**Proposal 6: Reuse SIB12 to carry the relay/discovery related configuration.**

**Proposal 7: Introduce explicit indication in NR SIB to indicate whether the gNB supports L2 relay. FFS for L3 relay and FFS on the detailed signaling design.**

**Proposal 14: The transmit operation in subclause 5.2.3 of TS 38.323[1] and the receive operation in subclause 5.2.4 of TS 38.323[1] can be reused for a SLRB of sidelink discovery message.**

**Proposal 15: The initial value of TX\_NEXT is set to 0 for sidelink discovery.**

**Proposal 16: The same principle for RX\_NEXT and RX\_DELIV in NR sidelink communication for broadcast and groupcast can be applied to sidelink discovery.**

**Proposal 17: PDCP reordering and in-order delivery is supported for sidelink discovery.**

**Proposal 18: For sidelink discovery, t-Reordering timer can be determined by receiving UE implementation.**

**Proposal 9: RAN2 to discuss whether there is any issue in RAN to support unicast and broadcast for SL-SRB4.**

**Proposal 10: RAN2 to discuss whether to support the range requirement for sidelink discovery.**

# Reference

1. R2-2109431 Remaining issues on discovery Qualcomm Incorporated
2. R2-2109512 Left Issues for Sidelink Discovery CATT
3. R2-2109809 Discussion on SL discovery resource pool configuration Nokia,Nokia Shanghai Bell
4. R2-2109857 Further discussion on Relay discovery ZTE, Sanechips
5. R2-2109903 Left issues for SL discovery Ericsson
6. R2-2109932 Using Shared and Dedicated Resource Pools for Discovery InterDigital
7. R2-2109960 Leftover aspects of discovery for L2 U2N relaying Intel Corporation
8. R2-2110218 Remaining Issues of Discovery Message Transmission vivo
9. R2-2110271 Remaining issues of Relay Discovery MediaTek Inc.
10. R2-2110304 Relay Discovery for L2 and L3 relay Lenovo, Motorola Mobility
11. R2-2110452 PDCP layer aspects for SL discovery Samsung
12. R2-2110489 Remaining issues on relay discovery Huawei, HiSilicon
13. R2-2110500 Discussion on common issues for relay and non-relay discovery OPPO
14. R2-2110501 Discussion on non-relay discovery OPPO, Apple, Samsung, Ericsson, Qualcomm
15. R2-2110749 Discovery Range for 5G ProSe Direct Discovery Xiaomi
16. R2-2110751 Discovery with simultaneous Shared and Dedicated Resource Pools Xiaomi