3GPP TSG-RAN WG1 Meeting #104-e R1-21xxxxx

e-Meeting, January 26th – February 5th, 2021

Agenda Item: 7.2.4

Source: Moderator (Ericsson)

Title: Feature lead summary#2 on Resource allocation for NR sidelink Mode 1

Document for: Discussion, Decision

# List of issues

## List of identified issues

[104-e-NR-5G\_V2X-03]: Issues related to SL HARQ-ACK reporting to gNB, till 1/28, with potential CRs till 2/2 – Ricardo (Ericsson)

* M1-1-1: How to multiplex SL HARQ-ACK on a PUSCH scheduled by DCI 0-2
* M1-1-2: Codebook configuration
* M1-1-4: Clarifications on PUCCH slot/resource determination
* “Simpler corrections” in M1-1-5-4 (Exceptional reports: Due to intra-prioritization: Correction because it applies to DG and CG), 7-2 (Clarification about PUCCH TX power), 7-3 (Clarification that higher layer parameter N1PUCCH-AN-r16 is used only for SL CG type 1) can be discussed during the CR preparation.

# M1-1-1: How to multiplex SL HARQ-ACK on a PUSCH scheduled by DCI 0-2

R1-2101436, R1-2101581 (TP4) propose to update Clause 16.5.1.2 and 16.5.2.2 in TS 38.213 to clarify that an UL transmission resulting in DL/SL HARQ-ACK information multiplexed in PUSCH may be scheduled by DCI format 2\_0. The text proposal is to make the following change:

* If a UE would multiplex HARQ-ACK information in a PUSCH transmission that is not scheduled by a DCI format or is scheduled by a DCI format ~~0\_0~~ that does not include a SAI field, then

**Proposal:**

* **Clarify in Clause 16.5.1.2 and 16.5.2.2 in TS 38.213 that an UL transmission resulting in DL/SL HARQ-ACK information multiplexed in PUSCH may be scheduled by DCI format 2\_0.**

**Company views**

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| **Company** | **View** |
| NTT DOCOMO | Agree. |
| LGE | It seems that there is a typo in the proposal. To be specific, “DCI format 2\_0” need to be fixed into “DCI format 0\_2”.  With this modification, we are fine with the proposal. |
| Apple | Agree with the proposal by changing “DCI format 2\_0” to “DCI format 0\_2”. |
| Sharp | Agree with LGE and Apple. |
| OPPO | Agree with LGE and Apple. |
| vivo | Another way to handle the multiplexing between PUSCH scheduled by DCI format 0\_2 and SL PUCCH is to introduce SAI field in DCI format 0\_2. Given that it has already been agreed that DCI format 0\_1 shall carry 1 or 2 bit SAI for handling SL HARQ-ACK and PUSCH multiplexing, it is feasible to apply the same mechanism to DCI format 0\_2. But if the majority prefer the updated proposal from LG, we can also accept it. **7.3.1.1.2 Format 0\_2** - Sidelink assignment index – 0, 1 or 2 bits:  - 1 bit if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *semi-static* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;  - 2 bits if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *dynamic* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;  - 0 bit otherwise. |
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# M1-1-2 Codebook configuration

The RRC parameter *pdsch-HARQ-ACK-Codebook* is used for determining the codebook used for reporting of SL HARQ-ACK information to the gNB. However, the Rel-16 specification determines that this parameter is ignored in some cases. If the parameter is ignored, it is unclear which codebook to use for reporting SL HARQ-ACK information to the gNB:

* R1-2101581 proposes that
  + Solution 1: “*pdsch-HARQ-ACK-Codebook* is followed even when *pdsch-HARQ-ACK-CodebookList* is configured”
* R1-2101533 discusses two potential solutions: Solution 1 above and
  + Solution 2: if only “semiStatic” is provided by either pdsch-HARQ-ACK-Codebook or pdsch-HARQ-ACK-CodebookList (whichever applicable), SL Type-1 HARQ-ACK codebook is used; otherwise SL Type-2 HARQ-ACK codebook is used.
* R1-2100515 proposes that “When a UE is provided pdsch-HARQ-ACK-Codebook-List, SL HARQ-ACK codebook type is determined by DL HARQ-ACK codebook of the same priority index of the PUCCH carrying SL HARQ-ACK reporting.”

As discussed in R1-2101581, At this stage it is desirable to minimize changes to the specification.

**Proposal:**

* **The parameter *pdsch-HARQ-ACK-Codebook* is ignored for reporting DL HARQ-ACK information but not for reporting SL HARQ-ACK information.**

**Company views**

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| NTT DOCOMO | Agree.  In addition, still one issue on HARQ-ACK CB is remaining. The case is when pdsch-HARQ-ACK-Codebook-SecondaryPUCCHgroup is provided. In this case, for Uu, pdsch-HARQ-ACK-Codebook is not ignored but is used only for primary PUCCH group. It means, UE uses each type for each PUCCH group. Which parameter is followed by SL should be clarified. |
| LGE | Not support.  In our understanding, depending on the decision that will be made in email thread#5, the PUCCH carrying SL HARQ-ACK report could be treated as URLLC PUCCH. In this case, it is natural that the UE follows the priority index of the PUCCH to determine the HARQ-ACK codebook type. To be specific, if the SL PUCCH is treated as URLLC, then the second codebook type in the list is used. If the SL PUCCH is treated as eMBB, then the first codebook type in the list is used. |
| Apple | Agree with the proposal. For small specification impact, we could assume SL HARQ-ACK codebook type is determined by “pdsch-HARQ-ACK-Codebook”. |
| Sharp | Agree with the principle of the proposal. In our understanding *pdsch-HARQ-ACK-Codebook* is only ignored when *pdsch-HARQ-ACK-Codebook-List* is configured, i.e. “*if parameter pdsch-HARQ-ACK-Codebook-List is configured, the parameter pdsch-HARQ-ACK-Codebook is ignored for reporting DL HARQ-ACK information but not for reporting SL HARQ-ACK information*”.  For the case mentioned by NTT DOCOMO, since the point here is to minimize the spec impact and to always follow *pdsch-HARQ-ACK-Codebook*, we don’t think any additional change is needed.  An LS to RAN2 is needed if the proposal is agreed. |
| OPPO | Agree with the proposal |
| vivo | Agree with the proposal as it is simple |
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# M1-1-4 Clarifications on PUCCH slot/resource determination

Regarding the implementation of the following agreement from RAN1#98bis:

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| Agreements:  For reporting SL HARQ-ACK to the gNB:   * For dynamic grant and configured grant type-2 in SL, the Rel-15 procedure and signalling for DL HARQ-ACK are reused for the purpose of selecting PUCCH offset/resource and format in UL.   + The configuration for SL is separate from Uu link for a UE   + FFS how to indicatae timing of transmission in PUCCH, including whether physical or logical slots are used * For configured grant type-1 in SL, RRC is used to configure PUCCH offset/resource and format in UL (if supported) |

R1-2101581 describes two errors:

* When DCI format 3\_0 for dynamic scheduling or CG type-2 activation does not include PSFCH-to-HARQ\_feedback timing indicator field, current spec is saying for feedback slot determination that sl-PSFCH-ToPUCCH-CG-Type1-r16 is used. The correct behaviour is to use sl-PSFCH-ToPUCCH-r16.
* For PUCCH resource determination corresponding to SL CG type-2, the current spec describes that PUCCH resource indicated by the activation DCI is used for each period. However, the correct behaviour is that the indicated resource is used only for initial period, and RRC-configured resource is applied for any subsequent periods.

**Proposal:**

* **Clarify that when DCI format 3\_0 does not include the PSFCH-to-HARQ\_feedback timing indicator field, the feedback slot is determined by sl-PSFCH-ToPUCCH-CG-Type1-r16 for CG type-1 and sl-PSFCH-ToPUCCH-r16 otherwise.**
* **Clarify that for configured grant type 2, the PUCCH resource for corresponding PUCCH transmission with HARQ-ACK information is provided by N1PUCCH-AN-r16 if there is no corresponding PDCCH.**

**Company views**

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| **Company** | **View** |
| NTT DOCOMO | Agree. |
| LGE | We are supportive of 1st bullet, but we are not support the 2nd bullet.  The higher layer parameter N1PUCCH-AN-r16 is a part of RRC configuration for Type 1 CG.  In this case, the network needs to always configure both Type 1 and Type 2 CG to enable the PUCCH transmission.  Our preference is that the PUCCH resource for the SL HARQ-ACK information with no PDCCH is indicated by the corresponding activation DCI. |
| Apple | We support the first bullet.  For the second bullet, we think the current N1PUCCH-AN-r16 is configured only for type 1 configured grant, which should not be used for type 2 configured grant. The activation DCI indicated PUCCH resource could be used for type 1 configured grant without corresponding PDCCH. In other words, the current specification does not need to be modified. |
| Sharp | Same view as Apple. |
| OPPO | We support the 1st bullet.  For the 2nd bullet, we agree with LGE’s comment. The parameter N1PUCCH-AN-r16 is configured for CG type-1, not for CG type 2. If it is applied to CG type 2, which means CG type 1 should be configured. While it is up to gNB’s implementation to configure either one or both of them.  Furthermore, for CG type 2, only periodicity is configured by RRC, the other parameter for resource determination is configured by DCI 3-0, such as PSCCH/PSSCH and PUCCH resources. For the CG period with associated DCI (1st CG period), the PSCCH/PSSCH/PUCCH resource is determined by DCI. For the CG periods without associated DCI, the resources for PSCCH/PSSCH/PUCCH can be seen as the mapping of corresponding PSCCH/PSSCH/PUCCH resource in the first period. |
| vivo | We support the first bullet but the second bullet is not needed. |
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In addition, R1-2101581 includes two related clarifications

* In TS 38.213 Clause 16.5, add a reference to Clause 9.2.3 for the mapping between PSFCH-to-HARQ\_feedback timing indicator field and sl-PSFCH-ToPUCCH-r16, for mapping between PUCCH resource indicator field and PUCCH resource indexes, and for how to transmit HARQ-ACK information via PUCCH format 0/1/2/3/4.
* Clarify that up to four PUCCH resources may be provided by *SL-PUCCH-Config-r16*

These issues are discussed in M1-7-3.

# Other corrections

Companies are encouraged to provide early input on the following corrections, especially about potential conflicts with the changes proposed above.

## M1-1-5-4 Exceptional reports: Due to intra-prioritization: Correction because it applies to DG and CG),

R1-2100137 includes the following correction (Other TPs – TP1)

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| **-------------------------- Start of Text Proposal for TS 38.213 --------------------------** 16.5 UE procedure for reporting HARQ-ACK on uplink **<Unchanged parts omitted>**  The UE generates a NACK when, due to prioritization, as described in Clause 16.2.4, the UE does not receive PSFCH in any PSFCH reception occasion associated with a PSSCH transmission in a resource provided by a DCI format 3\_0 or, for a configured grant, in a resource provided in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information. The priority value of the NACK is same as the priority value of the PSSCH transmission.  The UE generates a NACK when, due to prioritization as described in Clause 16.2.4, the UE does not transmit a PSSCH in any of the resources provided by a DCI format 3\_0 or, for a configured grant, in any of the resources provided in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information. The priority value of the NACK is same as the priority value of the PSSCH that was not transmitted due to prioritization.  **<Unchanged parts omitted>**  **-------------------------- End of Text Proposal --------------------------** |

**Company views**

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| **Company** | **View** |
| NTT DOCOMO | Agree. |
| LGE | Agree |
| Apple | Agree |
| Sharp | Agree |
| OPPO | Agree |
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## M1-7-2 Clarification about PUCCH TX power

R1-2101345 includes the following clarification (Other TPs – TP1):

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| **-------------------------- Start of Text Proposal for TS 38.213 --------------------------** 16.5 UE procedure for reporting HARQ-ACK on uplink A UE can be provided PUCCH resources or PUSCH resources [12, TS 38.331] to report HARQ-ACK information that the UE generates based on HARQ-ACK information that the UE obtains from PSFCH receptions, or from absence of PSFCH receptions. The UE reports HARQ-ACK information on the primary cell of the PUCCH group, as described in Clause 9, of the cell where the UE monitors PDCCH for detection of DCI format 3\_0. The PUCCH transmission power is as described in Clause 7.2.1, with .  **<Unchanged parts omitted>**  **-------------------------- End of Text Proposal --------------------------** |

**Company views**

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| **Company** | **View** |
| NTT DOCOMO | Agree. |
| LGE | Agree |
| Apple | Agree |
| Sharp | Agree |
| OPPO | Agree |
| vivo | **Disagree, this change is not needed.**  According to the spec,  is the TPC indicated by DCI scheduling PDSCH or the TPC in a received group common DCI format 2-2. For example, for SR transmission on PUCCH occasion *i* without a scheduling DCI, TPC in a received DCI format 2-2 be can be used to determine the corresponding .  So even if SL DCI indicating PUCCH occasion *i* for SL HARQ-ACK feedback does not include a TPC command field, gNB still can adjust the power of PUCCH occasion *i* by group common DCI format 2-2 and in this case  is not zero.  TS 38.213 7.2.1  -  is a TPC command value included in a DCI format scheduling a PDSCH reception for active UL BWP  of carrier  of the primary cell  that the UE detects for PUCCH transmission occasion , or is jointly coded with other TPC commands in a DCI format 2\_2 with CRC scrambled by TPC-PUCCH-RNTI [5, TS 36.212], as described in Clause 11.3  **On the other hand, regarding  for PUCCH power control for SL HARQ reporting, we think changes is needed when PUCCH 2/3/4 is used**.  According to the text below, we can observe that the PUCCH power control component  is related to the number of bits of UCI.  TS 38.213 7.2.1    - For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where  -  -  -  is a number of HARQ-ACK information bits that the UE determines as described in Clause 9.1.2.1 for Type-1 HARQ-ACK codebook and as described in Clause 9.1.3.1 for Type-2 HARQ-ACK codebook. If the UE is not provided *pdsch-HARQ-ACK-Codebook*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise,  -  is a number of SR information bits that the UE determines as described in Clause 9.2.5.1  -  is a number of CSI information bits that the UE determines as described in Clause 9.2.5.2  If a PUCCH format2/3/4 used for SL HARQ-ACK reporting and the number of HARQ-ACK bits is larger than 11, then  and  should be set to 0 since multiplexing between SL HARQ-ACK and CSI/SR is not allowed, and  should be set to the number of the SL HARQ-ACK bits determined in Clause 16.5.1 for type1 codebook or Clause 16.5.2 for type2 codebook.  The corresponding TP is provided in our contribution R1-2100412 but is not included in the summary, I copied the TP below for reference  **16.5.1.1 Type-1 HARQ-ACK codebook in physical uplink control channel**  If , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as where is a number of HARQ-ACK information bits determined for corresponding PSSCH transmissions with corresponding PSFCH reception occasions in PSFCH reception occasion .  If , and if the PUCCH transmission uses PUCCH format 2 or PUCCH format 3 or PUCCH format 4, the UE determines a transmission power for the PUCCH, as described in Clause 7.2.1, except that  -  =.  - =0  - =0  **16.5.2.1 Type-2 HARQ-ACK codebook in physical uplink control channel**  If , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in Clause 7.2.1, as  where  - is a value of a counter SAI field in a last DCI format 3\_0 scheduling PSSCH transmissions associated with PSFCH reception occasions that the UE detects within the PDCCH monitoring occasions  - if the UE does not detect any DCI format 3\_0 scheduling PSSCH transmissions associated with PSFCH reception occasions in any of the PDCCH monitoring occasions  - is a total number of DCI format 3\_0, scheduling PSSCH transmissions associated with PSFCH reception occasions, that the UE detects within the PDCCH monitoring occasions. if the UE does not detect any DCI format 3\_0 scheduling PSSCH transmissions with associated PSFCH reception occasions in any of the PDCCH monitoring occasions  - is a number of DCI format 3\_0 scheduling PSSCH transmissions with associated PSFCH reception occasions that the UE detects in PDCCH monitoring occasion  - is a number of SL configured grants for which the UE transmits corresponding HARQ-ACK information in a same PUCCH as for HARQ-ACK information corresponding to PSFCH reception occasions within the PDCCH monitoring occasions  If , and if the PUCCH transmission uses PUCCH format 2 or PUCCH format 3 or PUCCH format 4, the UE determines a transmission power for the PUCCH, as described in Clause 7.2.1, except that  -  =.  - =0  - =0 |
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## M1-7-3 Clarification that higher layer parameter N1PUCCH-AN-r16 is usd only for SL CG type 1.

In R1-2100515 and R1-2101581 the following TP is discussed (see also the related discussion for M1-1-4):

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| **-------------------------- Start of Text Proposal for TS 38.213 --------------------------** 16.5 UE procedure for reporting HARQ-ACK on uplink **<Unchanged parts omitted>**  A UE does not expect to be provided PUCCH resources or PUSCH resources to report HARQ-ACK information that start earlier than after the end of a last symbol of a last PSFCH reception occasion, from a number of PSFCH reception occasions that the UE generates HARQ-ACK information to report in a PUCCH or PUSCH transmission, where  - and are defined in [4, TS 38.211]  - , where is the SCS configuration of the SL BWP and is the SCS configuration of the active UL BWP on the primary cell  - is determined from according to Table 16.5-1  Table 16.5-1: Values of   |  |  | | --- | --- | |  |  | | 0 | 14 | | 1 | 18 | | 2 | 28 | | 3 | 32 |   For DCI format 3\_0, if present, the PSFCH-to-HARQ\_feedback timing indicator field values map to values for a set of number of slots provided by *sl-PSFCH-ToPUCCH-r16* as defined in Table 9.2.3-1 by replacing "by *dl-DataTo-UL-ACK* or by *dl-DataTo-UL-ACKForDCIFormat1\_2*" with "by *sl-PSFCH-ToPUCCH-r16*".  With reference to slots for PUCCH transmissions and for a number of PSFCH reception occasions ending in slot , the UE provides the generated HARQ-ACK information in a PUCCH transmission within slot , subject to the overlapping conditions in Clause 9.2.5, where is a number of slots indicated by a PSFCH-to-HARQ\_feedback timing indicator field, if present, in a DCI format indicating a slot for PUCCH transmission to report the HARQ-ACK information, or is provided by *sl-PSFCH-ToPUCCH-r16* for dynamic grant and SL configured grant type 2, or *sl-PSFCH-ToPUCCH-CG-Type1* for SL configured grant type 1. corresponds to a last slot for a PUCCH transmission that would overlap with the last PSFCH reception occasion assuming that the start of the sidelink frame is same as the start of the downlink frame [4, TS 38.211].  For a PSSCH transmission by a UE that is scheduled by a DCI format, or for a SL configured grant Type 2 PSSCH transmission activated by a DCI format, the DCI format indicates to the UE that a PUCCH resource is not provided when a value of the PUCCH resource indicator field is zero and a value of PSFCH-to-HARQ feedback timing indicator field, if present, is zero. For a SL configured grant Type 1 PSSCH transmission, a PUCCH resource can be provided by *sl-N1PUCCH-AN* and *sl-PSFCH-ToPUCCH-CG-Type1*. If a PUCCH resource is not provided, the UE does not transmit a PUCCH with generated HARQ-ACK information from PSFCH reception occasions.  For a PUCCH transmission with HARQ-ACK information, a UE determines a PUCCH resource after determining a set of PUCCH resources from up to four PUCCH resource sets provided by *sl-PUCCH-Config-r16*, for HARQ-ACK information bits, as described in Clause 9.2.1. The PUCCH resource determination is based on a PUCCH resource indicator field [5, TS 38.212] in a last DCI format 3\_0, among the DCI formats 3\_0 that have a value of a PSFCH-to-HARQ\_feedback timing indicator field indicating a same slot for the PUCCH transmission, that the UE detects and for which the UE transmits corresponding HARQ-ACK information in the PUCCH where, for PUCCH resource determination, detected DCI formats are indexed in an ascending order across PDCCH monitoring occasion indexes.  The PUCCH resource indicator field values map to values of a set of PUCCH resource indexes, as described in Clause 9.2.3.  If a UE transmits HARQ-ACK information corresponding only to PSFCH reception without a corresponding PDCCH, a PUCCH resource for corresponding PUCCH transmission with HARQ-ACK information is provided by *N1PUCCH-AN-r16*.  A UE transmits a PUCCH with HARQ-ACK information using PUCCH format 0 or PUCCH format 1 or PUCCH format 2 as described in Clause 9.2.3.  A UE does not expect to multiplex HARQ-ACK information for more than one SL configured grants in a same PUCCH.  A priority value of a PUCCH transmission with one or more sidelink HARQ-ACK information bits is the smallest priority value for the one or more HARQ-ACK information bits.  In the following, the CRC for DCI format 3\_0 is scrambled with a SL-RNTI or a SL-CS-RNTI.  **<Unchanged parts omitted>**  **-------------------------- End of Text Proposal --------------------------** |

**Company views**

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| **Company** | **View** |
| NTT DOCOMO | Agree with a correction.  The last text needs to include ‘PUCCH format 3 or PUCCH format 4’ between ‘PUCCH format 2’ and ‘as described…’. (Sorry for my mistake.) |
| LGE | As mentioned in M1-1-4, since the higher layer parameter N1PUCCH-AN-r16 is a part of RRC configuration for Type 1 CG, when the network only configures SL Type 2 CG, there is no way to use the parameter N1PUCCH-AN-r16. So, we need to remove the following sentence.  “If a UE transmits HARQ-ACK information corresponding only to PSFCH reception without a corresponding PDCCH, a PUCCH resource for corresponding PUCCH transmission with HARQ-ACK information is provided by *N1PUCCH-AN-r16*.” |
| Apple | We think “N1PUCCH-AN-r16” only applies to type 1 configured grant. Hence, we are fine with removing the sentence mentioned by LG. |
| OPPO | As commented in M1-1-4, not support the modification about “N1PUCCH-AN-r16”. Prefer to remove the sentence mentioned by LG. |
| vivo | Same view as LG  And format2 /3/4 should be added  A UE transmits a PUCCH with HARQ-ACK information using PUCCH format 0 or PUCCH format 1 or PUCCH format 2 or PUCCH format 3 or PUCCH format 4 as described in Clause 9.2.3. |
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# Appendix – List of identified contributions

R1-2100137 Remaining open issues and corrections for mode 1 and mode 2 RA OPPO

R1-2100411 Maintenance on resource allocation mechanisms for NR sidelink vivo

R1-2100515 Discussion on essential corrections in resource allocation for Mode 1 and 2 LG Electronics

R1-2100734 A remaining issue on Mode-1 resource allocation for NR sidelink Fujitsu

R1-2100937 Remaining issues on mode1 ZTE, Sanechips

R1-2101345 Remaining Issue of Mode 1 Resource Allocation Apple

R1-2101436 Remaining Issues in Mode 1 Resource Allocation Qualcomm Incorporated

R1-2101533 Remaining issues on resource allocation for NR sidelink Sharp

R1-2101581 Maintenance for resource allocation mechanism mode 1 NTT DOCOMO, INC.

R1-2101649 Remaining issues on type-1 HARQ-ACK codebook considering multiple sidelink reosurce pools ASUSTeK