# **[100b-e-NR-5G\_V2X\_NRSL-SL\_PHY\_Procedure-03] Indicating SL HARQ feedback related information**

[100b-e-NR-5G\_V2X\_NRSL-PHY-Procedure-03] Email discussion/approval regarding indicating SL HARQ feedback related information

* How to indicate HARQ feedback Option to RX UE
* How to indicate whether SL HARQ feedback is enabled or disabled to RX UE
* Whether to support mixing blind and feedback-based retransmissions of a TB

till 4/24, with potential TPs by 4/29 (Hanbyul, LGE)

**1. How to indicate SL HARQ feedback enabling/disabling and HARQ feedback Option to RX UE**

Q1: Do you agree that at least two 2nd SCI formats are defined, one containing Zone ID and Communication range requirement and another one not containing them?

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| Company | Answer |
| NTT DOCOMO | Support. |
| Huawei, HiSilicon | We think that two 2nd SCI formats are enough. One format containing Zone ID and communication range requirement is for groupcast option 1, while the other format which does not contain them is for broadcast/unicast/groupcast option 2. |
| Apple | Agree |
| Intel | Agree to define at least two SCI formats: one contains ranging info, the other does not contain. |
| ZTE, Sanechips | Agree. |
| Futurewei | Agree |
| OPPO | Agree |
| CATT | Agree |
| vivo | OK |
| LG | Yes. Since the total number of bits for Zone ID and Communication range requirement is quite large (16 bits), it would be beneficial to separate the 2nd-SCI format to reduce 2nd-SCI overhead at least for broadcast, unicast, and groupcast with non-distance based HARQ feedback. |
| Lenovo/MoTM | Yes, two 2nd SCI formats are defined one for distance based HARQ feedback and another one for the non-distance based HARQ feedback |
| CMCC | Agree. Two different 2nd-stage SCI formats are supported for groupcast HARQ feedback, where   * In one format, Zone ID field and communication range requirement field are present in the 2nd-stage SCI, and groupcast HARQ feedback Option 1 (i.e. NACK-only feedback with M\_ID=0) can be used. * In other format, neither Zone ID field nor communication range requirement field is present in the 2nd-stage SCI. Groupcast HARQ feedback Option 2 (i.e. ACK/NACK feedback with M\_ID of the RX UE) and unicast HARQ feedback (i.e. ACK/NACK feedback with M\_ID=0) can be used. |
| Xiaomi | Yes, agree |
| Samsung | Agree. |
| Spreadtrum | Agree and support only two 2nd SCI formats. |
| Fraunhofer | Agree |
| ITRI | Agree |
| Ericsson | Yes |
| Qualcomm | Agree |
| Nokia, NSB | Agree |
| Bosch | Agree |
| InterDigital | Agree |
| Panasonic | Agree |

**Observation:**

* **Consensus on supporting at least two 2nd SCI formats, one containing Zone ID and Communication range requirement and another one not containing them**

Q1-1: If the answer to Q1 is yes, which HARQ operation can be selected when the 2nd SCI format contains Zone ID and Communication range requirement?

- Candidates for HARQ operation: No HARQ feedback, GC HARQ feedback Option 1, GC HARQ feedback Option 2, unicast HARQ feedback

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| Company | Answer |
| NTT DOCOMO | GC HARQ feedback Option 1 only. |
| Huawei, HiSilicon | Only GC HARQ feedback for Option 1 |
| Apple | GC HARQ feedback Option 1 is associated with the 2nd SCI format contains Zone ID and Communication range requirement. |
| Intel | In these terms: No HARQ feedback, GC HARQ feedback Option 1  The HARQ operation options can be updated to the more generic:   * Blind / No HARQ feedback * Range-based + NACK-only * Range-based + ACK/NACK (for completeness, but not required) * Range-tolerant + NACK-only (for completeness, but not required) * Range-tolerant + ACK/NACK   In the updated terms: No HARQ feedback, Range-based + NACK-only, Range-based + ACK/NACK |
| ZTE, Sanechip | GC HARQ feedback Option 1 with Tx-Rx distance based operation only. |
| Futurewei | GC HARQ feedback Option 1 only. |
| OPPO | GC HARQ feedback Option 1 only. |
| CATT | GC HARQ feedback Option 1 only |
| vivo | We have 2 alternatives for this questions. Alt.1: No HARQ feedback and GC HARQ feedback; Alt. 2: GC HARQ feedback Option 1 only.  We think this issue is related to other issues which is under discussion. Whether mixed blind and HARQ based retransmission can be supported or not. Whether actual 2nd SCI overhead is used as TBS calculation assumption. If answers to both of the above issues are ‘yes’, we have to go to the Alt. 1, assuming initial transmission without HARQ and retransmission with HARQ, their 2nd SCIs have to be the same format. |
| LG | In our view, it can be used for GC HARQ feedback Option 1 only since the distance based HARQ feedback is supported only for the GC HARQ feedback Option 1.  In this case, GC HARQ feedback option indicator and HARQ feedback request indicator would not be included in this format. |
| Lenovo/MoTM | HF 1, HF 2  We don’t need to differentiate cast type. HF2 can be included in the distance based as part of future releases and completeness. However no optimization is required to be done for distance based HF2 as part of R16 |
| CMCC | GC HARQ feedback Option 1 only |
| Xiaomi | GC HARQ feedback Option 1 only, and when location based HARQ feedback is enabled |
| Samsung | GC HARQ feedback Option 1 only |
| Spreadtrum | GC HARQ feedback Option 1. |
| Fraunhofer | GC HARQ feedback Option 1 with distance-based criteria enabled. |
| ITRI | GC HARQ feedback Option 1 only. |
| Ericsson | GC HARQ feedback Option 1 |
| Qualcomm | GC HARQ feedback for Option 1 |
| Nokia, NSB | Option 1 only. |
| Bosch | GC HARQ feedback Option 1 |
| InterDigital | GC HARQ feedback option 1 only |
| Panasonic | GC HARQ feedback option 1 only. |

**Observation:**

* **HARQ operation(s) for 2nd SCI format containing Zone ID and Communication range requirement** 
  + **no HARQ feedback: Intel, vivo (2)**
  + **GC HARQ feedback Option 1: DOCOMO, Huawei, Apple, ZTE, Futurewei, OPPO, CATT, LG, CMCC, Xiaomi, Samsung, Spreadtrum, Fraunhofer, ITRI, Ericsson, Qualcomm, Nokia, Bosch, InterDigital, Lenovo, Intel, vivo, Panasonic (22)**
  + **GC HARQ feedback Option 2: Lenovo (1)**

Q1-2: If the answer to Q1 is yes, which HARQ operation can be selected when the 2nd SCI format does NOT contains Zone ID and Communication range requirement?

- Candidates for HARQ operation: No HARQ feedback, GC HARQ feedback Option 1, GC HARQ feedback Option 2, unicast HARQ feedback

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| Company | Answer |
| NTT DOCOMO | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback. |
| Huawei, HiSilicon | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Apple | No HARQ feedback, GC HARQ feedback Option 2 and unicast HARQ feedback |
| Intel | In the updated terms as mentioned in Q1-1: No HARQ feedback, Range-tolerant + NACK-only, Range-tolerant + ACK/NACK |
| ZTE, Sanechips | No HARQ feedback, GC HARQ feedback Option 1 w/o Tx-Rx distance based operation, GC HARQ feedback Option 2, unicast HARQ feedback |
| Futurewei | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback. |
| OPPO | No HARQ feedback, GC HARQ feedback Option 1 w/o Tx-Rx distance based operation, GC HARQ feedback Option 2, unicast HARQ feedback |
| CATT | No HARQ feedback, GC HARQ feedback Option 1, GC HARQ feedback Option 2, unicast HARQ feedback |
| LG | This format can be used for No HARQ feedback, GC HARQ feedback Option 1, GC HARQ feedback Option 2, unicast HARQ feedback.  In case of GC HARQ feedback Option 1, non-distance based GC HARQ feedback can be used. When the number of PSFCH resources are not sufficient to support GC HARQ feedback Option 2, the feedback-based groupcast can be supported. When the TX UE’s location is not available, the feedback-based groupcast can be supported.  In this case, at least GC HARQ feedback option indicator needs to be present in the 2nd-SCI format without Zone ID and Communication range requirement. |
| Lenovo/MoTM | No HARQ feedback, HF 1, HF 2  We don’t need to differentiate cast type. |
| CMCC | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Xiaomi | For unicast & GC without HARQ feedback, unicast with HARQ feedback, GC feedback option 1 w/o distance based feedback, GC feedback option 2 |
| Samsung | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Spreadtrum | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Fraunhofer | No HARQ feedback, GC HARQ feedback option 1 (with distance-based criteria disabled), GC HARQ feedback option 2, unicast HARQ feedback |
| ITRI | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Ericsson | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Qualcomm | Broadcast, GC HARQ feedback for Option 2, Unicast |
| Nokia, NSB | Candidates other than Option 1 |
| Bosch | BC/No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback. |
| InterDigital | No HARQ feedback, GC HARQ feedback Option 2, unicast HARQ feedback |
| Panasonic | No HARQ feedback, GC HARQ feedback option 1 and option 2, unicast HARQ feedback. GC HARQ feedback option 1 can be used when PSFCH resource is not sufficient number of the resource. Which one is used is up to Tx UE. |

**Observation:**

* **HARQ operation(s) for 2nd SCI format not containing Zone ID and Communication range requirement** 
  + **no HARQ feedback: DOCOMO, Huawei, Apple, Intel, ZTE, Futurewei, OPPO, CATT, LG, Lenovo, CMCC, Xiaomi, Samsung, Spreadtrum, Fraunhofer, ITRI, Ericsson, Qualcomm, Nokia, Bosch, InterDigital, Panasonic (22)**
  + **GC HARQ feedback Option 1: Intel, ZTE, OPPO, CATT, LG, Lenovo, Xiaomi, Fraunhofer, Panasonic (9)**
  + **GC HARQ feedback Option 2: DOCOMO, Huawei, Apple, Intel, ZTE, Futurewei, OPPO, CATT, LG, Lenovo, CMCC, Xiaomi, Samsung, Spreadtrum, Fraunhofer, ITRI, Ericsson, Qualcomm, Nokia, Bosch, InterDigital, Panasonic (22)**
  + **Unicast HARQ feedback: DOCOMO, Huawei, Apple, Intel, ZTE, Futurewei, OPPO, CATT, LG, CMCC, Xiaomi, Samsung, Spreadtrum, Fraunhofer, ITRI, Ericsson, Qualcomm, Nokia, Bosch, InterDigital, Panasonci (21)**

Q1-3: If the answer to Q1 is yes, how many 2nd-SCI formats are defined for those with and without Zone ID and Communication range requirement? In each format, is an explicit field included to indicate whether SL HARQ feedback is enabled or disabled, and/or which option is used?

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| Company | Answer |
| NTT DOCOMO | Two: one is with zone ID and communication range requirement, another is without.  For the first one, no field is defined for feedback = enabled/disabled. No field is defined for which option is used.  For the second one, one field is defined for feedback = enabled/disabled. No field is defined for which option is used. |
| Huawei, HiSilicon | Only two 2nd SCI formats are defined and a 1 bit length explicit field in SCI format 0-1 is used to indicate which format is used.The HARQ enable/disable indication can be done by an explicit field contained in the 1st stage SCI as well. |
| Apple | Two 2nd SCI formats are defined.  For the 2nd SCI format with zone ID and communication range requirement, no explicit field is included to indicate whether SL HARQ feedback is enabled or disabled. In this case, SL HARQ feedback with GC option 1 is always enabled.  For the 2nd SCI format without zone ID and communication range requirement, explicit field is included to indicate whether SL HARQ feedback is enabled or disabled, and which feedback option is used. |
| Intel | Two formats:   * Range-based format   + Feedback enabled/disabled flag in 2nd stage SCI is present   + Optionally, NACK only, or ACK-NACK option flag can be present in 2nd stage SCI * Range-tolerant format:   + Feedback enabled/disabled flag in 2nd stage format present only if PSFCH is configured for a resource pool   Optionally, NACK only, or ACK-NACK option flag can be present in 2nd stage SCI |
| ZTE, Sanechips | Just one format for the case in Q1-1 and a second format for the case in Q1-2. The explicit enable/disable bit and HARQ feedback option bit are contained in the format w/o zone ID and range requirement, but are not contained in the format with zone ID and range requirement. |
| Futurewei | Two formats are enough: one for option 1 with range, one for the other cases of the previous question. One field indicates if HARQ feedback is enabled |
| OPPO | Two formats:   * With zone ID and range info: apply to GC HARQ feedback option 1 only; * Without zone ID and range info: apply to GC option 1, GC option 2, broadcast, unicast. Two bits is used to indicate whether feedback is enabled/disable, and to differentiate unicast and groupcast;   HARQ feedback options – 2bits:  • 00 - HARQ feedback disabled;  • 01- groupcast HARQ feedback option-1;  • 10 - groupcast HARQ feedback option-2;  • 11 - unicast HARQ feedback;  The motivation to differentiate unicast and groupcast is that the resource selection of PSFCH for unicast and groupcast is different ( where is zero for unicast, is in-group ID for groupcast). if the UE cannot differentiate unicast or groupcast, it does not how to select the resource for PSFCH. While the differentiation cannot based on destination ID. The destination ID set for unicast/groupcast/broadcast can overlap (RAN2 is discussing how to differentiate cast-type). Specific field in SCI should be used to differentiate unicast and groupcast. |
| CATT | Only two 2nd SCI formats, one is used with zone ID and communication range, another is used without zone ID and communication range.  Only in the SCI format without zone ID and communication range, one field is introduced to enable or disable SL HARQ feedback. |
| vivo | Totally 3 formats can be supported. Considering the forward compatibility, the SCI formats used for broadcast can be separated, so that any future extension to unicast/groupcast would never have compatibility issue to broadcast. |
| LG | We think that two 2nd-SCI formats are introduced in Rel-16 NR sidelink; One is for 2nd-SCI format with Zone ID and Communication range requirement and the other is for 2nd-SCI format without Zone ID and Communication range requirement.  Considering NR Uu link discussion, large number of DCI format size is not preferable for UE complexity. That’s why DCI format size budget is introduced in NR Uu link. Similarly, the number of SCI format size needs to be minimized as much as possible. We are supportive of introducing three SCI format sizes; one for the 1st-SCI format, two for the 2nd-SCI formats. |
| Lenovo/MoTM | Two 2nd SCI formats are defined one for distance based HARQ feedback and another one for the non-distance based HARQ feedback.  Yes, explicit SCI field in the 1st SCI indicate whether SL HARQ enable/disable.  SL HARQ feedback option 1 or 2 is signaled in the 1st SCI. If it is specified in the 2nd SCI, HF field remains unused when SL HARQ is disabled in the 1st SCI |
| CMCC | Only two different 2nd-stage SCI formats are supported for groupcast HARQ feedback, where   * In one format, Zone ID field and communication range requirement field are present in the 2nd-stage SCI, and groupcast HARQ feedback Option 1 (i.e. NACK-only feedback with M\_ID=0) can be used. * In other format, neither Zone ID field nor communication range requirement field is present in the 2nd-stage SCI. Groupcast HARQ feedback Option 2 (i.e. ACK/NACK feedback with M\_ID of the RX UE) and unicast HARQ feedback (i.e. ACK/NACK feedback with M\_ID=0) can be used. |
| Xiaomi | One SCI format including zone ID and ranging requirement, which does not need the explicit field for GC FB option 1 or option 2; the other SCI format without zone ID and ranging requirement, which need the explicit field for GC FB option 1 or option 2. We also support a third format for broadcast only which does not need the explicit field for GC feedback option1 or option2. |
| Samsung | Two SCI formats with 1-bit flag in 2nd stage SCI for differentiation.  One format with distance information: this format is for GC HARQ option 1 only, thus no indication field for enabling/disabling of HARQ is needed.  The other one without distance information: 1-bit flag for enabling/disabling of HARQ. No indication field for unicast/groupcast is needed. |
| Spreadtrum | Support two 2nd SCI formats:   * SCI format 0\_2\_1 is used for groupcast option 1, with Zone ID field and communication range requirement field included. * One-bit indication is included to indicate HARQ feedback enabling/disabling * SCI format 0\_2\_2 is used for unicast, groupcast option 2, and broadcast, without Zone ID field and communication range requirement field included. * Two-bit indication is included to distinguish unicast, groupcast option 2, broadcast. * One-bit indication is included to indicate HARQ feedback enabling/disabling in unicast and groupcast. |
| Fraunhofer | Two 2nd stage SCIs for Rel. 16 V2X.  One 2nd stage SCI format containing the Zone ID and communication range requirement (distance-related fields), which does not have any additional field.  One 2nd stage SCI format without the distance-related fields, and an explicit 2-bit field indicating the following feedback options:   * Feedback is disabled (or blind re-transmissions), * Groupcast HARQ feedback option 1 without the distance-based criteria, * Groupcast HARQ feedback option 2, and * Unicast HARQ feedback. |
| ITRI | We support only 2nd SCI formats, one is used with zone ID and communication range, another is used without zone ID and communication range |
| Ericsson | - The two formats mentioned in the questions are the only formats defined for 2nd SCI.  - Yes, an explicit field (1 bit) is needed in each format. |
| Qualcomm | 4 formats, one for broadcast, one for groupcast option 1, one for groupcast option 2, one for unicast. We see to clear benefit of lumping different cast types to same SCI-2 format, as that would create confusion at MAC layer. |
| Nokia, NSB | Support two 2nd SCI formats: one format with zone ID and communication range requirement, and another format w/o this distance related information. The choice of { No HARQ feedback, GC HARQ feedback Option 1, GC HARQ feedback Option 2, unicast HARQ feedback} can be indicated in the 1st SCI. |
| Bosch | We agree with Qualcomm, 4 formats are needed for each cast type/option. The 2nd stage formats can be:   1. Broadcast short format 2. Groupcast option 1 format with Zone ID and communication range requirement 3. Groupcast option 2 format without distance-related fields 4. Unicast format   In the 1st stage, 2 bits may be used to declare these formats. Additionally, a HARQ enable/disable field (1-bit) need to be signaled also in 1st SCI, e.g., 0 🡪 disabled/BC, 1 enabled. |
| InterDigital | Two 2nd SCI formats. Also, 1 explicit bit in 1st SCI to indicate HARQ feedback enable/disable should be supported. A clarification is needed if HARQ feedback is disabled by indication in 1st SCI, the HARQ related field will be present in 2nd SCI or not? |
| Panasonic | Two 2nd SCI formats are defined for with and without zone ID and communication range requirement. 2nd SCI format without zone ID has a field of "HARQ feedback request" and "GC HARQ feedback option 1 or option 2". We also see the merit of having broadcast specific payload size. |

**Observation:**

* **Number of 2nd-SCI formats in Rel-16 NR sidelink**
  + **2: DOCOMO, Huawei, Apple, Intel, ZTE, Futurewei, OPPO, CATT, LG, Lenovo, CMCC, Samsung, Spreadtrum, Fraunhofer, ITRI, Ericsson, Nokia, InterDigital, Panasonic (19)**
  + **3: vivo, Xiaomi (2)**
  + **4: Qualcomm, Bosch (2)**

Q1-4: If the answer to Q1 no, do you agree that an explicit is necessary to indicate whether SL HARQ feedback is enabled or disabled, and which option is used?

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| Company | Answer |
| Huawei, HiSilicon | Enable/disable of HARQ should be a field in SCI format 0\_1. |
| Intel | Although we answered ‘yes’, we would like to provide our preference that SCI format 0-1 should not contain HARQ related information.  In this case, SCI 0-1 becomes non-forward compatible without good justification to do that. Furthermore, as SCI 0-1 was assumed to be cast-transparent, adding FB request to SCI 0-1 makes it unicast/groupcast oriented. |
| Lenovo/MoTM | SL HARQ enable/disable should be signaled in 1st SCI |
| Spreadtrum | We answered yes to Q1. Here we would like to further explain that enable/disable of HARQ should not be included in SCI format 0\_1, as the enabling/disabling mechanism only works for unicast and groupcast as agreed before. It’s not necessary for broadcast UE to decipher this in SCI format 0\_1. |
| Qualcomm | Enable/disable of HARQ should be a field in SCI format 0\_1. For the broadcast, the bit is simple 0 (no feedback). We think it benefits to make signaling as transparent as possible. |
| Bosch | We also answered “yes” to Q1. However, we would like to support having 1 bit in SCI format 0\_1, where BC or HARQ-disable may take the same value. |
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**Observation:**

* **For the case when a single 2nd-SCI format is introduced in Rel-16 NR sidelink, introduce explicit indication of HARQ operation enabling/disabling**
  + **In 1st SCI: Huawei, Lenovo, Qualcomm, Bosch, (4)**
  + **In 2nd SCI: Intel, Spreadtrum, (2)**

Q2: How does the RX UE decide whether unicast HARQ feedback and GC HARQ feedback Option 2 is in use?

- Option 1: Different 2nd-SCI formats

- Option 2: Explicit indicator in 2nd-SCI

- Option 3: Using L1-destination ID

- Option 4: Others (please specify it)

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| Company | Preferred option | Comments |
| NTT DOCOMO | Option 3 | If it is difficult that PHY layer knows associations between L1 destination ID and cast-type, i.e. option 3 is not agreed, our preference is option 2 to option 1. Option 1 means larger size of 1st SCI format or less capability of future enhancement. |
| Huawei, HiSilicon | Option 3 | However, we would like to understand why this differentiation is needed: the only obvious effect is how the UE knows which PSFCH resources to use, but this is a matter of ID, rather than of unicast vs. groupcast option 2. |
| Apple | Option 2 | This can be distinguished by a flag in 2nd-SCI |
| Intel | Option 3 | In our understanding, a UE should have a-priori knowledge about group communication, since it should also obtain in-group UE ID for groupcast option 2 operation.  PHY-layer in our understanding is transparent to unicast or connection-oriented groupcast operation. |
| ZTE, Sanechips | Option 3 | May use both layer 1 destination ID and L1 source ID |
| Futurewei | Option 3 | This may be a RAN2 issue only. Not sure why L1 would need the cast type |
| OPPO | Option 2 | Destination ID cannot be used to differentiate unicast and groupcast since the destination ID set for unicast/groupcast/broadcast can overlap. SO that it is possible that the destination ID for unicast and groupcast are same. |
| CATT | Option 3-likely | From our understanding, the source ID and destination ID are known by unicast pair.  The two IDs can be used by Rx UE to determine whether unicast HARQ feedback and GC HARQ feedback Option 2 is in use |
| vivo | Option 3 | We also have concern on the motivation. |
| LG | Option 2 | First of all, we prefer to minimize the number of 2nd-SCI formats for UE complexity.  In case of L1-destination ID, it is a truncated version of L2-destination ID. When the RX UE fails to decode PSSCH, the RX UE just knows 16-bits of L1-destination ID. In this case, it would not be always possible to distinguish GC HARQ feedback Option 2 and unicast. In other words, the RX UE may not know the value of M\_ID for PSFCH transmission.  In those points of views, we are supportive of Option 2. |
| Lenovo/MoTM | Option 3 | SCI does not need to indicate cast type. Unicast can be treated like a GC with member=1 and source-destination id for unicast is already known at the RX. After decoding the L1 destination id, the RX UE knows whether it is unicast or GC either by book-keeping or by querying from higher layers. |
| CMCC | Option 3 |  |
| Xiaomi | Option 3 | The receiving UE may not be able to map the UE destination ID to the cast type, but this is RAN2 issue. If RAN2 decides the option 3 is feasible, option 3 is preferred, otherwise option 2 is needed. |
| Samsung | Option 3 | In current SA specification 23.287, destination ID is differentiated over cast type.  Des-ID collision issue should be handled by RAN2/SA. For RAN1, the issue only relate to how to decide M\_ID for PSFCH resource determination. At least from single Rx UE perspective, it seems possible to configure separate destination IDs for unicast and groupcast. |
| Spreadtrum | Option 2 |  |
| Fraunhofer | Option 2 | Same indicator as described in Q1-3. |
| ITRI | Option 3 | In our view, Destination ID and Source ID may be used. |
| Ericsson | Option 3 | In our understanding this differentiation is not needed at PHY layer. |
| Qualcomm | Option 1 | We need to distinguish unicast/group cast for proper id matching at MAC layer. There is no address space separation between groupcast and unicast, even for L2 IDs |
| Nokia, NSB | Option 2 or Option 4 | Indication of unicast, groupcast, broadcast can be either in the 2nd-SCI (Option 2), or 1st-SCI (Option 4), which can be combined with the two 2nd-SCI format indication. |
| Bosch | Option1 (if not then Option 2) | As answered in Q1-3, we support different 2nd stage formats. However, if we cannot agree on this, we can at least support Option 2: Explicit indicator in 2nd-SCI.  We believe that L1-destination ID (alone and not L2) is not enough to distinguish between Unicast /groupcast if the truncated IDs overlap. |
| InterDigital | Option 2 | Both option 1 and 2 works fine but Option 2 seems to be the cleaner solution. Option 3 may not work due to the ID collision. |
| Panasonic | Option 3 or Option 1 | Option 3 can work if groupcast and unicast are operated only in the specific L1-destination ID. If it is not possible in the higher layer, our preference is option 1 as to minimize broadcast payload size is possible when broadcast specific payload size is introduced. |

**Observation:**

* **Option 1: Qualcomm, Nokia, Bosch, (3)**
* **Option 2: Apple, OPPO, LG, Spredtrum, Faunhofer, Nokia, InterDigital (7)**
* **Option 3: DOCOMO, Huawei, Intel, ZTE, Furturewei, CATT, vivo, Lenovo, CMCC, Xiaomi, Samsung, ITRI, Ericsson, Panasonic (14)**

**2. Whether to support mixing blind and feedback-based retransmissions of a TB**

Q3: Do you think mixing blind and feedback-based retransmission of a TB (as detailed in the following) is necessary?

Q3-1: Do you think the specification needs to support the following case? If yes, what is the motivation?

- transmission of a TB in a slot indicates “HARQ feedback disabled” but retransmission of the same TB in another slot indicates “HARQ feedback enabled”

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| Company | Answer |
| NTT DOCOMO | Not necessary.  Our original preference was to support but due to time limitation, Rel-16 should not support it. |
| Huawei, HiSilicon | This does not require specific support in RAN1 specifications. MAC indicates to PHY how to (re-)transmit the TB, so RAN2 can decide whether or not MAC has the proposed function. |
| Apple | Yes. The blind retransmission reduces the TB transmission latency by not waiting for HARQ feedback. The follow-up feedback-based retransmission further increases the reliability (with efficient spectrum usage). |
| Intel | Support the mix. RAN1 can provide to RAN2 its understanding that this mode should be supported, so that RAN2 can work out necessary modifications to MAC procedures.  Blind transmission(s) followed by the feedback-based re-transmissions is the main scenario, due to the following:   * In some cases, it is desirable to first gain the minimum link budget and resolve collisions in blind mode, and then continue with FB-based for fine-tuning * In GC option 1, half-duplex collision can lead to degradation of pure FB-based mode comparing to pure blind mode. To fix it, the transmission should start from 2-3 blind retransmissions and continue with FB-based retransmissions. It was analyzed in our tdoc R1-1910650. |
| ZTE, Sanechips | No. This is not allowed by current RAN2 spec. Any revert of RAN2 spec text should be discussed in RAN2.  In addition, such operation as in Q3-1 would need to open new investigation: whether the SL feedback enabled by SCI for k-th (re)transmission of a TB should reflect only the reception for k-th transmission or all reception history so far. For example, the Rx UE successfully received the transmission up to (k-1)-th (re)transmissions whose feedback are all disabled but then failed on reception of k-th retransmission whose feedback is enabled. What is the feedback in this case? Unfortunately even this discussion of how to set feedback content may also belong to RAN2 scope. |
| Futurewei | The RAN1 specification should not prevent this possibility. |
| OPPO | Support mix mode. No specific spec is needed in RAN1. Current spec in RAN1/2 does not pre-clude this possibility. It can be left to MAC implementation. |
| CATT | Yes. We think it would be more efficient to support the service with high reliability and latency requirements. |
| vivo | RAN1 does not need further specification effort to allow/prevent the cases. RAN1 has already support enabling/disabling HARQ operation via SCI indication, which is flexible enough, whether to have further specification impact or not can be up to RAN2. |
| LG | No, we think that once the logical channels enables SL HARQ feedback, the corresponding SCI needs to enables the SL HARQ feedback as well. With this operation, the RX UE can save the resources for PSFCH transmission for initial transmission, but the benefit is unclear since this unused resource will not be used or other purposes.  Furthermore, in case of GC HARQ feedback Option 1, such operation is not useful. For instance, a UE transmits groupcast PSSCH, the less chance of PSFCH transmission would make DTX problem worsened. For instance, if the SL HARQ feedback is disabled for initial transmission and SL HARQ feedback is enabled for retransmission, and if the RX UE fails to detect SCI scheduling retransmission, the RX UE will not transmit PSFCH and the TX UE may determine ACK for the TB. |
| Lenovo/MoTM | No, if a TB is formed from the LCH(s) containing SL HARQ disabled and later TX UE receives SL HARQ feedback, many things should be specified in the MAC HARQ protocol on how to process the feedback. Any behavior transparent to MAC can be specified for mixed mode operation or can be upto UE implementation in R16 |
| Xiaomi | No. If the retransmission indicating “HARQ feedback enabled” is lost, the Tx UE will consider all previous blind retransmissions are lost even if some of them is successfully received. The benefit of blind retransmission to resolve half duplex is lost. Therefore, we support that each blind retransmission also indicates “HARQ feedback enabled”. |
| Samsung | No. The mixture of will be transparent for RAN1 specification, but captured in RAN2 specification. It is not a good way to decide something have RAN2 impact at CR stage. In addition, the mixture is only further optimization rather than essential feature and the gain is still unclear. |
| Fraunhofer | Not necessary. |
| ITRI | This is the RAN 2 specification issue. |
| Ericsson | No. According to RAN2 agreements, logical channel can either be configured to use feedback based HARQ or blind retransmissions. Therefore, such mechanism of mixing blind and feedback based HARQ is not supported. It is not desirable to introduce such mechanism at this phase. |
| Qualcomm | Support the mix. One of the reason is NR V2X support URLLC. Blind transmission alone will lead to resource wastage. Feedback back transmission alone cannot meet high reliability due to half duplex |
| Nokia, NSB | No. |
| Bosch | We support mixing blind and feedback-based HARQ retransmissions. If we cannot specify, at least we should guarantee that RAN1 specs does not prohibit this option. |
| InterDigital | No, we don’t see any benefit to support the mix. If current spec already supports the mix, we are ok not to restrict it. But, if any additional specification is required, we should not support it. Would be good if proponents identify what is the additional specification impacts. |
| Panasonic | We support the mix. When Tx UE thinks the reliability of one PSSCH transmission is not enough, no need to request HARQ feedback for this PSSCH. |

**Observation:**

* **transmission of a TB in a slot indicates “HARQ feedback disabled” but retransmission of the same TB in another slot indicates “HARQ feedback enabled”**
  + **Support: Apple, Intel, Futurewei, OPPO, CATT, Qualcomm, Bosch, Panasonic (8)**
  + **Not support: DOCOMO, ZTE, LG, Lenovo, Xiaomi, Samsung, Fraunhofer, Ericsson, Nokia, InterDigital (10)**
  + **Up to RAN2: Huawei, vivo, ITRI, (3)**

Q3-2: Do you think the specification needs to support the following case? If yes, what is the motivation?

- transmission of a TB in a slot indicates “HARQ feedback enabled” but retransmission of the same TB takes place in another slot without considering the HARQ feedback corresponding to the first transmission

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| --- | --- |
| Company | Answer |
| NTT DOCOMO | Not necessary.  Our original preference was to support but due to time limitation, Rel-16 should not support it. |
| Huawei, HiSilicon | No, see Q3-1. |
| Apple | Yes, the feedback-based transmission increases the reliability with efficient spectrum usage. The follow-up blind retransmission reduces the TB transmission latency, especially when the PDB of the TB is approaching. |
| Intel | Not necessary. In our understanding, FB to blind transition cases are unjustified. |
| ZTE, Sanechips | No in RAN1 spec. Whether to consider feedback corresponding to earlier transmission(s) is in RAN2 scope. |
| Futurewei | This is not up to RAN1 to decide |
| OPPO | Not necessary |
| CATT | Not necessary |
| vivo | As commented in Q3-1. Moreover, it seems no strong motivation to support the mixing operation. |
| LG | Yes. We think this case can happen especially when more than one PSSCH slot is associated with a single PSFCH slot. For example, when two slots are determined for PSSCH transmission of a TB, it is possible that there is no PSFCH between the two slots. Such resource allocation can ensure enough number of transmissions of a TB within the given PDB. gNB can grants such resource allocation in mode 1 and the TX UE needs to perform such resource selection in mode 2 when enough retransmission is not possible within PDB. |
| Lenovo/MoTM | No, same as Q3-1 |
| Xiaomi | Yes. Blind retransmissions can be helpful to avoid half duplex. The blind retransmissions also indicate “HARQ feedback enabled” but Tx UE can transmit next blind retransmission without waiting for the feedback of previous ones. If “HARQ feedback enabled” is only indicated by the first or the last blind retransmission, the Tx UE may not get the correct transmission status if this retransmission is lost due to half duplex. |
| Samsung | Not necessary, see Q3-1. |
| Fraunhofer | Not necessary. If the decision to have HARQ enabled for a particular TB is based on its reliability criteria, the retransmission should essentially retain the same decision. |
| ITRI | Not necessary. |
| Ericsson | No. According to RAN2 agreements, logical channel can either be configured to use feedback based HARQ or blind retransmissions. Therefore, such mechanism of mixing blind and feedback based HARQ is not supported. It is not desirable to introduce such mechanism at this phase. |
| Qualcomm | Yes. It provides more flexibility to the UE. |
| Nokia, NSB | This can be done without specification support. The answer would be no. |
| Bosch | Yes, this can be supported |
| InterDigital | No |
| Panasonic | Yes. As the number of PSFCH feedback sent by a UE is limited like only one, there can be the situation PSFCH feedback reliability is not enough. To allow this operation can improve PSFCH feedback. Our understanding of RAN2 agreement on logical channel to use feedback based HARQ is just logical channel character. The issue discussed here is to improve the reliability of PSFCH (or PSSCH in Q3-1). Therefore, it has no collision with RAN2 agreement. |

**Observation:**

* **transmission of a TB in a slot indicates “HARQ feedback enabled” but retransmission of the same TB takes place in another slot without considering the HARQ feedback corresponding to the first transmission**
  + **Support: Apple, LG, Xiaomi, Qualcomm, Nokia, Bosch, Panasonic (7)**
  + **Not support: DOCOMO, Intel, OPPO, CATT, vivo, Lenovo, Samsung, Fraunhofer, ITRI, Ericsson, InterDigital, (11)**
  + **Up to RAN2: Huawei, ZTE, Futurewei, (3)**

Q3-3: Do you think there are other cases that needs to be considered as mixing blind and feedback-based retransmissions of a TB?

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| Company | Answer |
| Huawei, HiSilicon | No, see Q3-1. |
| ZTE, Sanechips | No |
| Futurewei | No. we do not see which case(s) to support as within RAN1 scope (nor we see the need to put restrictions at the RAN1 level) |
| Samsung | No |
| Ericsson | No. |
| Panasonic | No. |
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**Proposal 3-1: One SCI format (referred to as 2nd SCI format A) is defined as follows:**

* **This format includes Zone ID and Communication range requirement.**
* **When this format is received, it is implied that GC HARQ feedback option 1 with distance based HARQ feedback is enabled.**

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| Company | Comments |
| Panasonic | OK |
| NTT DOCOMO | Support |
| Fraunhofer | Agree |
| Ericsson | We are supportive of this proposal |
| Huawei, HiSilicon | Agree. |
| Apple | We support the first bullet.  For the second bullet, based on the observations on Q1-2, we feel more companies support GC HARQ feedback option 1 (with or without distance based HARQ feedback is enabled) is associated with 2nd SCI forma A.  Hence, we could either remove “with distance based HARQ feedback is enabled”, or change it to “GC HARQ feedback option 1 **at least** with distance based HARQ feedback is enabled.” |
| Intel | We have a preference that this format also has FB enable/disable flag.  We can accept as a compromise. |
| Lenovo/MoTM | We want an explicit SCI field to indicate GC HF 1, instead of implicitly determining with SCI format, the reason is forward compatibility and completeness to support GC HF 2 with distance-based HF. No further optimization is needed as part of R16 to support GC HF 2.  **When this format is received, SCI field determines whether GC HARQ feedback option 1 with distance based HARQ feedback is enabled** |
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**Proposal 3-2: One SCI format (referred to as 2nd SCI format B) is defined as follows:**

* **This format does not include Zone ID or Communication range requirement.**
* **This format includes an explicit field indicating**
  + **No HARQ feedback**
  + **GC HARQ feedback option 2 or unicast HARQ**
    - **(Working assumption) RAN1 assumes that higher layers can determine whether to use GC HARQ feedback option 2 or unicast HARQ based on the L1 ID(s) included in SCI.**
  + **FFS: GC HARQ feedback option 1 (to be revisited after the related RAN2 discussion)**

// FL’s note

* It seems reasonable to have an indication of HARQ enable/disable in 2nd SCI format as 2nd CSI format A always enables HARQ feedback if Proposal 3-1 is agreed.
* More companies supported ID based differentiation between GC HARQ option 2 and unicast, and it is proposed to take a working assumption and ask RAN2 whether this is feasible.
* My understanding is that RAN2 had an email discussion which includes the topic of HARQ option selection when PSFCH resources are insufficient in GC HARQ option 2. Use of GC HARQ feedback option 1 under 2nd SCI format B can be decided after the related RAN2 conclusion, and I think this is in line with the previous RAN1 conclusion that HARQ option will be selected in RAN2.

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| Company | Comments |
| Panasonic | OK |
| NTT DOCOMO | Support the proposal, including WA and FFS as it is.  Whether L1 ID can indicate unicast/groupcast should be asked to RAN2.  OK to have the FFS, considering the current RAN2 situation.  Hope that both aspects can be fixed easily once RAN2 have agreements for these. |
| Fraunhofer | Agree with proposal, and to wait on RAN2 for further inputs. |
| Ericsson | Supportive without the FFS part. We do not think that we need to list the FFS points. We can always revisit this agreement after RAN2 discussions and see if something needs to be done in RAN1. |
| Huawei, HiSilicon | We prefer the indication of Enable/Disable HARQ feedback is contained in 1st SCI, so the explicit filed indicating No HARQ feedback is not necessary. Besides, we don’t see the need for an FFS. If RAN1 receive further information, then the issue in that new information may be considered. |
| Apple | Support the proposal without the whole FFS sub-bullet. |
| Intel | Support the proposal.  As we indicated in one of the answers, FB enable/disable flag should be in the 2nd stage SCI. Having it in 1st stage messed up the whole concept of two stages and makes the 1st stage cast-aware. |
| Lenovo/MoTM | Agree |
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**Proposal 3-3: Send an LS to RAN2 regarding HARQ operations**

* **Proposal 3-2 is included to ask RAN2 feedback on the working assumption and FFS.**
* **RAN1 informs RAN2 that RAN1 discussed whether to support mixing blind and feedback-based HARQ retransmissions of a TB and RAN1 agreed that this is an issue RAN2 needs to make decision.**
  + **RAN1 notes the following agreements regarding the time gap between two resources of a TB when HARQ feedback is expected:**

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| *Agreements:*   * *In Step 2, a UE ensures a minimum time gap Z = a + b between any two selected resources of a TB where a HARQ feedback for the first of these resources is expected*    + *‘a’ is a time gap between the end of the last symbol of the PSSCH transmission of the first resource and the start of the first symbol of the corresponding PSFCH reception determined by resource pool configuration and higher layer parameters of MinTimeGapPSFCH and periodPSFCHresource*   + *‘b’ is a time required for PSFCH reception and processing plus sidelink retransmission preparation including multiplexing of necessary physical channels and any TX-RX/RX-TX switching time and is determined by UE implementation* |

// FL’s note

* My understanding is that RAN2 is discussing a similar issue of whether/how to handle a case where the number of resources is smaller than the maximum number of transmissions allowed for the TB.
* As some companies mentioned the keeping reliability within latency might be difficult in some cases where HARQ feedback always is enabled, informing the RAN1 agreement can be useful in the potential RAN2 discussion.

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| Company | Comments |
| Panasonic | OK |
| NTT DOCOMO | Support the proposal.  We are OK to include the information recommended by FL. |
| Ericsson | Do not agree with the proposal. In our view it is not needed to send and LS to RAN2 regarding this issue.    According to RAN2 agreements an LCH is configured either as HARQ enabled or disable, therefore, does not support the mix of feedback-based and blind retransmission. In our view, this may lead to a QoS mismatch between the LCH definition and how the transmission is treated at PHY layer. Moreover, the introduction of such new mechanism is not desirable at this phase of the release. |
| Huawei, HiSilicon | This looks like an LS that might be sent during a WI phase, but not during a maintenance phase. RAN1 does not need to add more work to the pile, and can act if, and in the terms of, any further information received from RAN2. |
| Apple | In the first bullet, we do not need to mention FFS. Otherwise, we support the proposal. |
| Intel | OK to send LS.  As mentioned by FL, RAN2 is also looking into similar issue, and the RAN1 LS can motivate them to decide it.  To repeat our concern on doing nothing, we believe GC Option 1 simply does not work w/o having at least the first transmission to be blind. We can consider other solutions to that, if it is acceptable. |
| Lenovo/MoTM | Ok to send LS..Please remove sentences --RAN1 notes the following agreements regarding the time gap between two resources of a TB when HARQ feedback is expected and the following agreements from the LS |
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