**3GPP TSG RAN WG1 #101 R1-20xxxxx**

**e-Meeting, May 25th – June 5th, 2020**

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**Source:** Moderator (LG Electronics)

**Title:** Text proposal from Email discussion thread #3 for AI 7.2.4.5 Physical layer procedures for sidelink

**Document for:** Discussion and decision

# **Introduction and proposal**

RAN1 made the agreements copied in Appendix in [101-e-NR-5G\_V2X\_NRSL-SL\_PHY\_Procedure-03] Email discussion/approval regarding HARQ operation + Sidelink CSI. This contribution includes the text proposal endorsed. It is proposed to adopt the text proposal in Section 2 for the following reasons

* Reason for change: RAN1 made the agreements to complete the UE procedure for sidelink HARQ operation and CSI reporting. The text proposal is to implement these agreements.
* Summary of change: SCI formats 2-A and 2-B and the related UE procedure are updated to introduce the fields for HARQ feedback enabling/disabling indication and the cast type indication. CQI table determination is introduced based on the indicated MCS table.
* Consequences if not approved: The specification is incomplete in supporting sidelink HARQ and CSI report.

# **Text proposal**

* 1. Text proposal for TS 38.212

===========================<Start of change #1>=======================

8.4 Sidelink control information on PSSCH

< Unchanged parts are omitted >

8.4.1 2nd-stage SCI formats

< Unchanged parts are omitted >

8.4.1.1 SCI format 2-A

SCI format 2-A is used for the decoding of PSSCH, with HARQ operation when HARQ-ACK information includes ACK or NACK, or when there is no feedback of HARQ-ACK information.

The following information is transmitted by means of the SCI format 2-A:

- HARQ Process ID – [x] bits as defined in clause 16.4 of [5, TS 38.213].

- New data indicator – 1 bit as defined in clause 16.4 of [5, TS 38.213].

- Redundancy version – 2 bits as defined in clause x.x.x of [6, TS 38.214].

- Source ID – 8 bits as defined in clause x.x.x of [6, TS 38.214].

- Destination ID – 16 bits as defined in clause x.x.x of [6, TS 38.214].

- HARQ feedback enabling/disabling indicator – 1 bit as defined in clause 16.3 of [5, TS 38.213].

- Cast type indicator – 2 bits as defined in Table 8.4.1.1-1.

- CSI request – 1 bit as defined in clause 8.2.1 of [6, TS 38.214].

**Table 8.4.1.1-1: Cast type indicator**

|  |  |
| --- | --- |
| **Value of Cast type indicator** | **Cast type** |
| 00 | Broadcast |
| 01 | Groupcast |
| 10 | Unicast |
| 11 | Reserved |

8.4.1.2 SCI format 2-B

SCI format 2-B is used for the decoding of PSSCH, with HARQ operation when HARQ-ACK information includes only NACK.

The following information is transmitted by means of the SCI format 2-B:

- HARQ Process ID – [x] bits as defined in clause 16.4 of [5, TS 38.213].

- New data indicator – 1 bit as defined in clause 16.4 of [5, TS 38.213].

- Redundancy version – 2 bits as defined in clause x.x.x of [6, TS 38.214].

- Source ID – 8 bits as defined in clause x.x.x of [6, TS 38.214].

- Destination ID – 16 bits as defined in clause x.x.x of [6, TS 38.214].

- HARQ feedback enabling/disabling indicator – 1 bit as defined in clause 16.3 of [5, TS 38.213].

- Zone ID – 12 bits as defined in clause x.x.x of [9, TS 38.331].

- Communication range requirement – 4 bits as defined in clause x.x.x of [9, TS 38.331]

< Unchanged parts are omitted >

============================<End of change #1>=======================

* 1. Text proposal for TS 38.213

===========================<Start of change #1>=======================

16.3 UE procedure for reporting HARQ-ACK on sidelink

A UE can be indicated by an SCI format scheduling a PSSCH reception, in one or more sub-channels from a number of $N\_{subch }^{PSSCH}$ sub-channels, to transmit a PSFCH with HARQ-ACK information in response to the PSSCH reception. The UE provides HARQ-ACK information that includes ACK or NACK, or only NACK.

A UE can be provided, by *periodPSFCHresource*, a number of slots in a resource pool for a period of PSFCH transmission occasion resources. If the number is zero, PSFCH transmissions from the UE in the resource pool are disabled.

A UE may be indicated by higher layers to not transmit a PSFCH in response to a PSSCH reception [11, TS 38.321].

If a UE receives a PSSCH in a resource pool and ~~a ZYX~~ the HARQ feedback enabling/disabling indicator field = 1 in the associated ~~a~~ SCI format ~~0\_~~2-A or SCI format 2-B ~~scheduling the PSSCH reception indicates to the UE to report HARQ-ACK information for the PSSCH reception~~ [5, TS 38.212], the UE provides the HARQ-ACK information in a PSFCH transmission in the resource pool. The UE transmits the PSFCH in a first slot that includes PSFCH resources and is at least a number of slots, provided by *MinTimeGapPSFCH*, of the resource pool after a last slot of the PSSCH reception.

< Unchanged parts are omitted >

A UE determines a $m\_{cs}$ value, for computing a value of cyclic shift $α$ [4, TS 38.211], as in Table 16.3-2 if the UE receives a SCI format 2-A with Cast type indicator field is 01 or 10 or Table 16.3-3 if the UE receives a SCI format 2-B ~~as indicated by a SCI format scheduling a PSSCH reception~~. The UE applies one cyclic shift from a cyclic shift pair to a sequence used for the PSFCH transmission [4, TS 38.211].

**Table 16.3-2: Mapping of HARQ-ACK information bit values to a cyclic shift, from a cyclic shift pair, of a sequence for a PSFCH transmission when HARQ-ACK information includes ACK or NACK**

|  |  |  |
| --- | --- | --- |
| **HARQ-ACK Value** | **0 (NACK)** | **1 (ACK)** |
| **Sequence cyclic shift** | 0 | 6 |

**Table 16.3-3: Mapping of HARQ-ACK information bit values to a cyclic shift, from a cyclic shift pair, of a sequence for a PSFCH transmission when HARQ-ACK information includes only NACK**

|  |  |  |
| --- | --- | --- |
| **HARQ-ACK Value** | **0 (NACK)** | **1 (ACK)** |
| **Sequence cyclic shift** | 0 | N/A |

============================<End of change #1>=======================

===========================<Start of change #2>=======================

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.

For SL configured grant Type 1 or Type 2 PSSCH receptions by a UE within a time period provided by *periodSlCG*, the UE generates one HARQ-ACK information bit in response to the PSFCH receptions to multiplex in a PUCCH transmission occasion that is after a last time resource, in a set of time resources.

For each 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, the UE can be indicated by ~~higher layers~~ SCI to perform one of the following and the UE constructs a HARQ-ACK codeword with HARQ-ACK information, when applicable.

If the UE receives PSFCH associated with a SCI format 2-A with Cast type indicator = 10,

- generate HARQ-ACK information with same value as a value of HARQ-ACK information the UE determines from a PSFCH reception in the PSFCH reception occasion and, if the UE determines that a PSFCH is not received at the PSFCH reception occasion, generate NACK

If the UE receives PSFCH associated with a SCI format 2-A with Cast type indicator = 01,

~~- generate ACK when the UE determines ACK from each PSFCH reception for the number of PSFCH reception occasions; otherwise, generate NACK if the UE determines absence of PSFCH reception or determines a NACK value from a PSFCH reception at a corresponding PSFCH reception occasion~~

- generate ACK when the UE determines ACK from at least one PSFCH reception for the number of PSFCH reception occasions of a PSFCH resource with an index with $M\_{ID}$, as determined in Clause 16.3, for every identity $M\_{ID}$ of the UEs expected to receive the PSSCH, as indicated by higher layers; otherwise, generate NACK.

If the UE receives PSFCH associated with a SCI format 2-B,

- generate ACK when the UE determines absence of PSFCH reception for each PSFCH reception occasion from the number of PSFCH reception occasions; otherwise, generate NACK

~~- generate ACK when the UE determines ACK from at least one PSFCH reception for the number of PSFCH reception occasions of a PSFCH resource with an index with~~ $M\_{ID}$~~, as determined in Clause 16.3, for every identity~~ $M\_{ID}$ ~~of the UEs expected to receive the PSSCH, as indicated by higher layers; otherwise, generate NACK.~~

The UE generates 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 with CRC scrambled by a SL-RNTI 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 UE generates 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 with CRC scrambled by SL-RNTI 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 UE generates ACK if the UE does not transmit a PSCCH with a SCI format 0\_1 scheduling a PSSCH in any of the resources provided by a configured grant in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information.

============================<End of change #2>=======================

* 1. Text proposal for TS 38.214

===========================<Start of change #1>=======================

8.5.2 Channel state information

8.5.2.1 CSI reporting quantities

8.5.2.1.1 Channel quality indicator (CQI)

The UE shall derive CQI as specified in section 5.2.2.1, with the following changes

- PDSCH replaced by PSSCH

- uplink slot replaced by sidelink slot

- downlink physical resource blocks replaced by sidelink physical resource blocks

- Transport Block Size determination according to Clause 8.1.3.2

- CSI reference resource according to ~~TODO~~ Clause 8.5.2.3

- interference measurements are not supported

- sub-band differential CQI is not supported

- *cqi-Table* is determined as indicated by Additional MCS table indicator in a SCI format 1-A,

 - *cqi-Table* = ‘table1’ if Additional MCS table indicator indicates Table 5.1.3.1-1,

 - *cqi-Table* = ‘table2’ if Additional MCS table indicator indicates Table 5.1.3.1-2,

 - *cqi-Table* = ‘table3’ if Additional MCS table indicator indicates Table 5.1.3.1-3

============================<End of change #1>=======================

# **Appendix: Agreements made in the email discussion [101-e-NR-5G\_V2X\_NRSL-SL\_PHY\_Procedure-03]**

Agreements:

* SCI format 2-A includes an explicit indication of HARQ feedback enabled/disabled.
* SCI format 2-B includes an explicit indication of HARQ feedback enabled/disabled.

Agreements:

* SCI format 2-A includes a 2-bit information field providing an explicit indication for the cast type

**Conclusion:**

* It is feasible from L1 signaling perspective to use Groupcast option 1 (i.e., NACK only feedback) when Zone ID or Communication range requirement is not provided, if RAN2 decides to support this operation.
	+ No action in RAN1 unless RAN2 informs RAN1 about their decision (to support or not)
	+ Note that if RAN2 decides to support it, RAN1 needs to further discuss

Agreemensts:

* Send an LS to RAN2 in response to R1-2003255 to inform
	+ The conclusion on Groupcast option 1 when Zone ID or Communication range requirement is not provided.
	+ The agreement as above

Agreements:

* The CQI table is derived based on the indicated MCS table
	+ No separate configuration