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

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

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **draft** | **rev** | **-** | **Current version:** |  |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | [Draft] Correction of SL HARQ-ACK information reporting to the gNB in Mode 1 |
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| ***Source to WG:*** | Moderator (Ericsson), NTT DOCOMO, OPPO, Ericsson |
| ***Source to TSG:*** | RAN WG1 |
|  |  |
| ***Work item code:*** | 5G\_V2X\_NRSL-Core |  | ***Date:*** | 2021-02-01 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | Correction of behavior for SL HARQ-ACK information reporting to the gNB in Mode 1 |
|  |  |
| ***Summary of change:*** | Correction to capture that the CRC of DCI format 3\_0 may be scrambled with other RNTI than SL-RNTI.Clarification 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.Clarification on the maximum number of PUCCH resource sets and how to transmit PUCCH with HARQ-ACK information using the corresponding PUCCH format.Capture the agreed behavior that an UL transmission resulting in DL/SL HARQ-ACK information multiplexed in PUSCH may be scheduled by DCI format 0\_2. |
|  |  |
| ***Consequences if not approved:*** | Reporting of SL HARQ-ACK information to the gNB in Mode 1 does not work properly |
|  |  |
| ***Clauses affected:*** | 16.5. 16.5.1.2, 16.5.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**<Unchanged parts omitted>**

## 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.

For SL configured grant Type 1 or Type 2 PSSCH transmissions by a UE within a time period provided by *sl-PeriodCG*, 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 PSSCH transmissions scheduled by a DCI format 3\_0, a UE generates HARQ-ACK information in response to PSFCH receptions to multiplex in a PUCCH transmission occasion that is after a last time resource in a set of time resources provided by the DCI format 3\_0.

For each PSFCH reception occasion, from a number of PSFCH reception occasions, the UE generates HARQ-ACK information to report in a PUCCH or PUSCH transmission. The UE can be indicated by a SCI format to perform one of the following and the UE constructs a HARQ-ACK codeword with HARQ-ACK information, when applicable

- if the UE receives a PSFCH associated with a SCI format 2-A with Cast type indicator field value of "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 a PSFCH associated with a SCI format 2-A with Cast type indicator field value of "01"

- generate ACK if the UE determines ACK from at least one PSFCH reception occasion, from the number of PSFCH reception occasions, in PSFCH resources corresponding to every identity $M\_{ID}$ of the UEs that the UE expects to receive the PSSCH, as described in Clause 16.3; otherwise, generate NACK

- if the UE receives a PSFCH associated with a SCI format 2-B or a SCI format 2-A with Cast type indicator field value of "11"

- 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

After a UE transmits PSSCHs and receives PSFCHs in corresponding PSFCH resource occasions, the priority value of HARQ-ACK information is same as the priority value of the PSSCH transmissions that is associated with the PSFCH reception occasions providing the HARQ-ACK information.

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.

The UE generates an ACK if the UE does not transmit a PSCCH with a SCI format 1-A 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. The priority value of the ACK is same as the largest priority value among the possible priority values for the configured grant.

A UE does not expect to be provided PUCCH resources or PUSCH resources to report HARQ-ACK information that start earlier than $T\_{prep}=$ $\left(N+1\right)∙\left(2048+144\right)∙κ∙2^{-μ}∙T\_{c}$ 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

- $κ$ and $T\_{c}$ are defined in [4, TS 38.211]

- $μ=min⁡(μ\_{SL},μ\_{UL})$, where $μ\_{SL}$ is the SCS configuration of the SL BWP and $μ\_{UL}$ is the SCS configuration of the active UL BWP on the primary cell

- $N$ is determined from $μ$ according to Table 16.5-1

Table 16.5-1: Values of $N$

|  |  |
| --- | --- |
| $$μ$$ | $$N$$ |
| 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 16.5-2.

Table 16.5-2: Mapping of PSFCH-to-HARQ\_feedback timing indicator field values to numbers of slots

|  |  |
| --- | --- |
| PSFCH-to-HARQ\_feedback timing indicator  | Number of slots  |
| 1 bit | 2 bits | 3 bits |  |
| '0' | '00' | '000' | 1st value provided by *sl-PSFCH-ToPUCCH-r16*  |
| '1' | '01' | '001' | 2nd value provided by *sl-PSFCH-ToPUCCH-r16* |
|  | '10' | '010' | 3rd value provided by *sl-PSFCH-ToPUCCH-r16* |
|  | '11' | '011' | 4th value provided by *sl-PSFCH-ToPUCCH-r16* |
|  |  | '100' | 5th value provided by *sl-PSFCH-ToPUCCH-r16* |
|  |  | '101' | 6th value provided by *sl-PSFCH-ToPUCCH-r16* |
|  |  | '110' | 7th value provided by *sl-PSFCH-ToPUCCH-r16* |
|  |  | '111' | 8th value provided by *sl-PSFCH-ToPUCCH-r16* |

With reference to slots for PUCCH transmissions and for a number of PSFCH reception occasions ending in slot $n$, the UE provides the generated HARQ-ACK information in a PUCCH transmission within slot $n+k$, subject to the overlapping conditions in Clause 9.2.5, where $k$ 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 $k$ is provided by *sl-PSFCH-ToPUCCH-r16* for a transmission scheduled by a DCI format or for a SL configured grant type 2, or by *sl-PSFCH-ToPUCCH-CG-Type1* for a SL configured grant type 1. $k=0$ 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 $O\_{UCI}$ 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.

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.

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>**

#### 16.5.1.2 Type-1 HARQ-ACK codebook in physical uplink shared channel

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 without an SAI field, then

- if the UE

- has not received any PDCCH with a DCI format 3\_0 scheduling PSSCH transmissions with corresponding PSFCH reception occasions that the UE transmits corresponding HARQ-ACK information in the PUSCH, based on a value of a respective PSFCH-to-HARQ\_feedback timing indicator field in a DCI format scheduling the PSSCH transmissions or on the value of PSFCH-to-HARQ feedback timing indicator field in a DCI format 3\_0 activating a SL configured grant Type-2 transmission, or

- has not been provided PSSCH resources with corresponding PSFCH reception occasions that the UE transmits corresponding HARQ-ACK information based on the value of *sl-PSFCH-ToPUCCH-CG-Type1* for a SL configured grant Type-1, in any of the $M\_{A}$ occasions for candidate PSSCH transmissions with corresponding PSFCH reception occasions, as described in Clause 16.5.1.1,

the UE does not multiplex HARQ-ACK information in the PUSCH transmission;

- else the UE generates the HARQ-ACK codebook as described in Clause 16.5.1.1, unless the UE generates HARQ-ACK information only for

- PSFCH reception occasions associated with PSSCH transmissions corresponding to a SL configured grant, or

- PSFCH reception occasions associated with PSSCH transmissions that are scheduled by DCI format 3\_0 with a counter SAI field value of 1 in the $M\_{A}$ occasions for candidate PSSCH transmissions with corresponding PSFCH reception occasions,

in which case the UE generates HARQ-ACK information only for the PSFCH reception occasions as described in Clause 16.5.1.

A UE sets to NACK value in the HARQ-ACK codebook any HARQ-ACK information corresponding to PSFCH reception occasions associated with PSSCH transmissions scheduled by a DCI format 3\_0 that the UE detects in a PDCCH monitoring occasion that starts after a PDCCH monitoring occasion where the UE detects a DCI format scheduling the PUSCH transmission.

If a UE multiplexes HARQ-ACK information in a PUSCH transmission that is scheduled by a DCI format that includes a SAI field, the UE generates the HARQ-ACK codebook as described in Clause 16.5.1.1 when a value of the SAI field in the DCI format is $V\_{T-SAI}^{UL}=1$. The UE does not generate a HARQ-ACK codebook for multiplexing in the PUSCH transmission when $V\_{T-SAI}^{UL}=0$ unless the UE generates HARQ-ACK information only for

- PSFCH reception occasions associated with PSSCH transmissions corresponding to a SL configured grant, or

- PSFCH reception occasions associated with PSSCH transmissions that are scheduled by a DCI format 3\_0 with a counter SAI field value of 1 in the $M\_{A}$ occasions for candidate PSSCH transmissions with corresponding PSFCH reception occasions as described in Clause 16.5.1.

$V\_{T-SAI}^{UL}=0$ if the SAI field in the DCI format is set to '0'; otherwise, $V\_{T-SAI}^{UL}=1$.

**<Unchanged parts omitted>**

#### 16.5.2.2 Type-2 HARQ-ACK codebook in physical uplink shared channel

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 without an SAI field, then

- if the UE

- has not received any PDCCH within the monitoring occasions for DCI format 3\_0 for scheduling PSSCH with corresponding PSFCH reception occasions on any serving cell, and

- does not have HARQ-ACK information in response to a PSSCH transmission with corresponding PSFCH reception occasions associated with a SL configured grant to multiplex in the PUSCH, as described in Clause 16.5.2.1,

the UE does not multiplex HARQ-ACK information in the PUSCH transmission;

- else, the UE generates and multiplexes in the PUSCH transmission the HARQ-ACK codebook as described in Clause 16.5.2.1.

If a UE multiplexes HARQ-ACK information in a PUSCH transmission that is scheduled by a DCI format that includes a SAI field, the UE generates the HARQ-ACK codebook as described in Clause 16.5.2.1, with the following modifications:

- For the pseudo-code for the HARQ-ACK codebook generation in Clause 16.5.2.1, after the completion of the $m$ loop, the UE sets $V\_{temp}=V\_{SAI}^{UL}$ where $V\_{SAI}^{UL}$ is the value of the SAI field in the DCI format according to Table 16.5.2.2-1.

If a UE

- is scheduled for a PUSCH transmission by a DCI format that includes a SAI field with value $V\_{T-SAI}^{UL}=4$, and

- has not received any PDCCH within the monitoring occasions for PDCCH with DCI format 3\_0 for scheduling PSSCH with corresponding PSFCH reception occasions on a serving cell, and

- does not have HARQ-ACK information in response to PSFCH reception occasions associated with a SL configured grant to multiplex in the PUSCH, as described in Clause 16.5.2.1,

the UE does not multiplex HARQ-ACK information in the PUSCH transmission.

Table 16.5.2.2-1: Value of SAI

|  |  |  |
| --- | --- | --- |
| SAIMSB, LSB | $V\_{T-SAI}^{UL}$  | Number of PDCCH monitoring occasions in which DCI format 3\_0 scheduling PSSCH transmissions with corresponding PSFCH reception occasions is present, denoted as $X$ and $X\geq 1$ |
| 0,0 | 1 | $$\left(X-1\right)mod4+1=1$$ |
| 0,1 | 2 | $$\left(X-1\right)mod4+1=2$$ |
| 1,0 | 3 | $$\left(X-1\right)mod4+1=3$$ |
| 1,1 | 4 | $$\left(X-1\right)mod4+1=4$$ |

**<Unchanged parts omitted>**