**3GPP TSG RAN WG1 #107-e** **R1-210xxxx**

**e-Meeting, November 11th – 19th, 2021**

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| *CR-Form-v12.0* |
| **DRAFT CHANGE REQUEST** |
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|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **16.7.0** |  |
|  |
| *For* [***HE******LP***](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:***  | Introduction of sidelink enhancements in NR |
|  |  |
| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_SL\_enh-Core |  | ***Date:*** | 2021-11-29 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-17 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | Introduction of sidelink enhancement in NR. |
|  |  |
| ***Summary of change:*** | Include reporting of conflict information and corresponding UE procedures for transmission/reception of PSFCH with the conflict information. |
|  |  |
| ***Consequences if not approved:*** | Incomplete support for sidelink enhancements in NR. |
|  |  |
| ***Clauses affected:*** | 16.2.4.3.1, 16.3, 16.3.0 (new, due to rearrangement), 16.3.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.211, TS 38.212, TS 38.214 |
| ***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 text is omitted \*\*\*

#### 16.2.4.3 Simultaneous SL and UL transmissions/receptions

If a UE

- would simultaneously transmit on the UL and on the SL in a carrier or in two respective carriers, and

- the UE is not capable of simultaneous transmissions on the UL and on the SL in the carrier or in the two respective carriers

the UE transmits only on the link, UL or SL, with the higher priority.

If a UE

- would simultaneously transmit on the UL and receive on the SL in a carrier, or

- would simultaneously transmit on the UL and receive on the SL in two respective carriers and the UE is not capable of simultaneous transmission on the UL and reception on the SL in the two respective carriers

the UE transmits on UL or receives on SL, with the higher priority.

If a UE

- is capable of simultaneous transmissions on the UL and on the SL in two respective carriers,

- would transmit on the UL and on the SL in the two respective carriers,

- the transmission on the UL would overlap with the transmission on the SL over a time period, and

- the total UE transmission power over the time period would exceed

the UE

- reduces the power for the UL transmission prior to the start of the UL transmission, if the SL transmission has higher priority than the UL transmission as determined in clause 16.2.4.3.1, so that the total UE transmission power would not exceed

- reduces the power for the SL transmission prior to the start of the SL transmission, if the UL transmission has higher priority than the SL transmission as determined in clause 16.2.4.3.1, so that the total UE transmission power would not exceed

##### 16.2.4.3.1 Prioritizations for sidelink and uplink transmissions/receptions

A UE performs prioritization between SL transmissions/receptions and UL transmissions after performing the procedures described in clause 9, clause 9.2.5, and clause 9.2.6, and in clause 6.1 of [6, TS 38.214].

PSFCH transmissions in a slot have a same priority value as the smallest priority value among PSSCH receptions with corresponding control information provided by the PSFCH transmissions in the slot, as described in clause 16.3.

PSFCH receptions in a slot have a same priority value as the smallest priority value among PSSCH transmissions with corresponding control information provided by the PSFCH receptions in the slot, as described in clause 16.3.

A priority of S-SS/PSBCH block transmission or reception is provided by *sl-SSB-PriorityNR.*

For prioritization between SL transmission or PSFCH/S-SS/PSBCH block reception and UL transmission other than a PRACH, or a PUSCH scheduled by an UL grant in a RAR and its retransmission, or a PUSCH corresponding to Type-2 random access procedure and its retransmission, or a PUCCH with sidelink HARQ-ACK information report

- if the UL transmission is for a PUSCH or for a PUCCH with priority index 1,

- if *sl-PriorityThreshold-UL-URLLC* is provided

- the SL transmission or reception has higher priority than the UL transmission if the priority value of the SL transmission(s) is smaller than *sl-PriorityThreshold-UL-URLLC*;otherwise, the UL transmission has higher priority than the SL transmission or reception

- else

- the UL transmission has higher priority than the SL transmission or reception

- else

- the SL transmission or reception has higher priority than the UL transmission if the priority value of the SL transmission(s) or reception is smaller than *sl-PriorityThreshold*;otherwise, the UL transmission has higher priority than the SL transmission or reception

A PRACH transmission, or a PUSCH scheduled by an UL grant in a RAR and its retransmission, or a PUSCH for Type-2 random access procedure and its retransmission, or a PUCCH with HARQ-ACK information in response to successRAR, or a PUCCH indicated by a DCI format 1\_0 with CRC scrambled by a corresponding TC-RNTI has higher priority than a SL transmission or reception.

A PUCCH transmission with a sidelink HARQ-ACK information report has higher priority than a SL transmission if a priority value of the PUCCH is smaller than a priority value of the SL transmission. The priority value of the PUCCH transmission is as described in clause 16.5. If the priority value of the PUCCH transmission is larger than the priority value of the SL transmission, the SL transmission has higher priority.

A PUCCH transmission with a sidelink HARQ-ACK information report has higher priority than a PSFCH/S-SS/PSBCH block reception if a priority value of the PUCCH is smaller than a priority value of the SL reception. If the priority value of the PUCCH transmission is larger than the priority value of the PSFCH/S-SS/PSBCH block reception, the SL reception has higher priority.

When one or more SL transmissions from a UE overlap in time with multiple non-overlapping UL transmissions from the UE, the UE performs the SL transmissions if at least one SL transmission is prioritized over all UL transmissions subject to the UE processing timeline with respect to the first SL transmission and the first UL transmission.

When one or more UL transmissions from a UE overlap in time with multiple non-overlapping SL transmissions, the UE performs the UL transmissions if at least one UL transmission is prioritized over all SL transmissions subject to the UE processing timeline with respect to the first SL transmission and the first UL transmission.

When one SL transmission overlaps in time with one or more overlapping UL transmissions, the UE performs the SL transmission if the SL transmission is prioritized over all UL transmissions subject to both the UE multiplexing and processing timelines with respect to the first SL transmission and the first UL transmission, where the UE processing timeline with respect to the first SL transmission and the first UL transmission is same as when one or more SL transmissions overlap in time with multiple non-overlapping UL transmissions.

When one SL transmission overlaps in time with one or more overlapping UL transmissions, the UE performs the UL transmission if at least one UL transmission is prioritized over the SL transmission subject to both the UE multiplexing and processing timelines with respect to the first SL transmission and the first UL transmission, where the UE processing timeline with respect to the first SL transmission and the first UL transmission is same as when one or more SL transmissions overlap in time with multiple non-overlapping UL transmissions.

## 16.3 UE procedure for reporting and obtaining control information in PSFCH

Control information provided by a PSFCH transmission includes HARQ-ACK information and/or conflict information.

### 16.3.0 UE procedure for transmitting PSFCH with control information

A UE can be indicated by an SCI format scheduling a PSSCH reception 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 *sl-PSFCH-Period*, 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 expects that a slot ) has a PSFCH transmission occasion resource if , where is defined in [6, TS 38.214], and is a number of slots that belong to the resource pool within 10240 msec according to [6, TS 38.214], and is provided by *sl-PSFCH-Period*.

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

If a UE receives a PSSCH in a resource pool and the HARQ feedback enabled/disabled indicator field in an associated SCI format 2-A or a SCI format 2-B has value 1 [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 *sl-MinTimeGapPSFCH*, of the resource pool after a last slot of the PSSCH reception.

A UE is provided by *sl-PSFCH-RB-Set* a set of PRBs in a resource pool for PSFCH transmission with at least HARQ-ACK information in a PRB of the resource pool. A UE can be provided by *sl-PSFCH-Conflict-RB-Set* a set of PRBs in a resource pool for PSFCH transmission with conflict information in a PRB of the resource pool. For a number of sub-channels for the resource pool, provided by *sl-NumSubchannel*, and a number of PSSCH slots associated with a PSFCH slot that is less than or equal to , the UE allocates the PRBs from the PRBs to slot among the PSSCH slots associated with the PSFCH slot and sub-channel , where , , , and the allocation starts in an ascending order of and continues in an ascending order of . The UE expects that isa multiple of *.*

The second OFDM symbol 𝑙′of PSFCH transmission in a slot is defined as 𝑙′= *startSLsymbols*+ *lengthSLsymbols* - 2.

A UE determines a number of PSFCH resources available for multiplexing HARQ-ACK or conflict information in a PSFCH transmission as where is a number of cyclic shift pairs for the resource pool provided by *sl-NumMuxCS-Pair* and, based on an indication by *sl-PSFCH-CandidateResourceType*,

- if *sl-PSFCH-CandidateResourceType* is configured as *startSubCH*, and the PRBs are associated with the starting sub-channel of the corresponding PSSCH;

- if *sl-PSFCH-CandidateResourceType* is configured as *allocSubCH*, and the PRBs are associated with the sub-channels of the corresponding PSSCH.

The PSFCH resources are first indexed according to an ascending order of the PRB index, from the PRBs, and then according to an ascending order of the cyclic shift pair index from the cyclic shift pairs.

A UE determines an index of a PSFCH resource for a PSFCH transmission with HARQ-ACK information in response to a PSSCH reception or with conflict information corresponding to a reserved resource as where is a physical layer source ID provided by SCI format 2-A or 2-B [5, TS 38.212] scheduling the PSSCH reception or reserving the resource associated with the conflict information, or by SCI format 2-A or 2-B with corresponding SCI format 1-A reserving the resource associated with the conflict information and, for HARQ-ACK information, is the identity of the UE receiving the PSSCH as indicated by higher layers if the UE detects a SCI format 2-A with Cast type indicator field value of "01"; otherwise, is zero. For conflict information, is zero.

For a PSFCH transmission with HARQ-ACK information, a UE determines a value, for computing a value of cyclic shift [4, TS 38.211], from a cyclic shift pair index corresponding to a PSFCH resource index and from using Table 16.3-1.

Table 16.3-1: Set of cyclic shift pairs

|  |  |
| --- | --- |
|  |  |
| **Cyclic Shift Pair Index 0** | **Cyclic Shift Pair Index 1** | **Cyclic Shift Pair Index 2** | **Cyclic Shift Pair Index 3** | **Cyclic Shift Pair Index 4** | **Cyclic Shift Pair Index 5** |
| 1 | 0 | - | - | - | - | - |
| 2 | 0 | 3 | - | - | - | - |
| 3 | 0 | 2 | 4 | - | - | - |
| 6 | 0 | 1 | 2 | 3 | 4 | 5 |

For a PSFCH transmission with HARQ-ACK information, a UE determines a value, for computing a value of cyclic shift [4, TS 38.211], as in Table 16.3-2 if the UE detects a SCI format 2-A with Cast type indicator field value of "01" or "10", or as in Table 16.3-3 if the UE detects a SCI format 2-B or a SCI format 2-A with Cast type indicator field value of "11". 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 |

A UE can be provided for a resource pool, by *inter-UECoordinationScheme2*, to transmit a PSFCH that includes conflict information.

A UE can determine, based on an indication by an SCI format 1-A, a set of one or more slots and resource blocks reserved for PSSCH transmission [6, TS 38.214]. If the UE determines a conflict for a reserved resource for PSSCH transmission, the UE provides conflict information in a corresponding PSFCH resource.

A resource conflict occurs when a first UE that provides the conflict information in a PSFCH

- is an intended receiver for a reserved resource of a PSSCH transmission in a slot, and

- does not expect to perform reception on the sidelink due to half-duplex operation in the slot

A first UE determines a UE to additionally provide the conflict information in a PSFCH as follows

- if for a resource pool XYZ1 is disabled, the first UE has a first reserved resource and a second reserved resource as resources for PSSCH reception or, if for a resource pool *XYZ* is enabled, has at least the first reserved resource or the second reserved resource for PSSCH reception,

- detects a first SCI format 1-A that includes a first priority value, , and the first reserved resource for PSSCH transmission from a second UE,

- detects a second SCI format 1-A that includes a second priority value, , and the second reserved resource for PSSCH transmission from a third UE, and

- determines that the first and second resources overlap in time and frequency

- determines to transmit to the second UE the PSFCH with the conflict information

The first UE can be provided conditions by *ABC* to determine conflict of reserved resources in a resource pool

- if *ABC* = ‘rule1’, the first UE can be provided by, *ThresPSSCH-RSRP-List* , a list of RSRP thresholds for each priority combination [6, TS 38.214]

- if the first UE is an intended receiver for PSSCH in a reserved resource of the second UE, the first UE determines a resource conflict if the RSRP [6, TS 38.214] of the third UE is above a threshold

- if the first UE is an intended receiver for PSSCH in a reserved resource of the third UE, the first UE determines a resource conflict if the RSRP of the second UE is above a threshold

- if *ABC* = ‘rule2’, the first UE can be provided a value by *deltaRSRPThresh*

- if the first UE is an intended receiver for PSSCH in a reserved resource of the second UE, the first UE determines a resource conflict if , where and are the RSRP measurements from the first UE for the second UE and the third UE, respectively

- if the first UE is an intended receiver for PSSCH in a reserved resource of the third UE, the first UE determines a resource conflict if

If a UE transmits a PSFCH with conflict information corresponding to a reserved resource indicated in an SCI format 1-A, the UE transmits the PSFCH in the resource pool in a slot determined based on *PSFCHOccasionScheme2*

* If *PSFCHOccasionScheme2* = ‘followSCI’, the UE transmits the PSFCH in a first slot that includes PSFCH resources and is at least a number of slots, provided by *sl-MinTimeGapPSFCH*, of the resource pool after a slot of a PSCCH reception that provides the SCI format 1-A. The PSFCH resource is in a slot that is at least slots [6, TS 38.214] before the resource associated with the conflict information.
* If *PSFCHOccasionScheme2* = ‘followReservedResource’, the UE transmits the PSFCH in a latest slot that includes PSFCH resources and is at least slots before a slot of the resource associated with conflict information. The PSFCH resource is in a slot that is at least slots after a slot of a PSCCH reception that provides the SCI format 1-A

### 16.3.1 UE procedure for receiving PSFCH with control information

A UE that transmitted a PSSCH scheduled by a SCI format 2-A or a SCI format 2-B that indicates HARQ feedback enabled, attempts to receive associated PSFCHs with HARQ-ACK information according to PSFCH resources determined as described in clause 16.3.0. The UE determines an ACK or a NACK value for HARQ-ACK information provided in each PSFCH resource as described in [10, TS 38.133]. The UE does not determine both an ACK value and a NACK value at a same time for a PSFCH resource.

For each PSFCH reception occasion, from a number of PSFCH reception occasions, the UE generates HARQ-ACK information to report to higher layers. For generating the HARQ-ACK information, the UE can be indicated by a SCI format to perform one of the following

- if the UE receives a PSFCH associated with a SCI format 2-A with Cast type indicator field value of "10"

- report to higher layers HARQ-ACK information with same value as a value of HARQ-ACK information that the UE determines from the PSFCH reception

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

- report an ACK value to higher layers if the UE determines an ACK value from at least one PSFCH reception occasion from the number of PSFCH reception occasions in PSFCH resources corresponding to every identity of UEs that the UE expects to receive corresponding PSSCHs as described in clause 16.3; otherwise, report a NACK value to higher layers

- 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"

- report to higher layers an ACK value if the UE determines absence of PSFCH reception for the PSFCH reception occasion; otherwise, report a NACK value to higher layers

A UE that transmitted SCI format 1-A, indicating one or more reserved resources, and provided by *inter-UECoordinationScheme2* a resource pool, attempts to receive associated PSFCH with conflict information in PSFCH resources that the UE determines as described in clause 16.3.0. If the UE determines presence of a resource conflict based on conflict information in a PSFCH reception, the UE informs the resource conflict to higher layers to re-select one or more of the reserved resources.