**3GPP TSG RAN WG1 #108-e** **R1-220xxxx**

**e-Meeting, February 21st – March 3rd, 2022**

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| *CR-Form-v12.0* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **17.0.0** |  |
|  | | | | | | | | |
| *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:*** | Corrections on coverage enhancements in NR | | | | | | | | | |
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| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_cov\_enh-Core | | | | |  | ***Date:*** | | | 2022-03-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***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 can be 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)* | |
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| ***Reason for change:*** | | Corrections on coverage enhancements in NR. | | | | | | | | |
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| ***Summary of change:*** | | 1. Capture how a UE determines to transmit with repetitions a PUSCH scheduled by a RAR UL grant or by a DCI format 1\_0 with CRC scrambled by a TC-RNTI in clause 8.3. 2. Capture frequency hopping across slots depending on whether or not DM-RS bundling is enabled in clause 9.2.6. 3. Capture that a UE does not multiplex UCI from a PUCCH transmission with repetitions in a PUSCH with TB processing over multiple slots in clause 9.2.6. | | | | | | | | |
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| ***Consequences if not approved:*** | | Incomplete support for coverage enhancements in NR. | | | | | | | | |
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| ***Clauses affected:*** | | 8.3, 9.2.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 \*\*\*

## 8.3 PUSCH scheduled by RAR UL grant

An active UL BWP with SCS configuration , as described in clause 12 and in [4, TS 38.211], for a PUSCH transmission scheduled by a RAR UL grant is indicated by higher layers.

If *useInterlacePUCCH-PUSCH* is not provided by *BWP-UplinkCommon* and *BWP-UplinkDedicated*, for determining the frequency domain resource allocation for the PUSCH transmission within the active UL BWP

- if the active UL BWP and the initial UL BWP have same SCS and same CP length and the active UL BWP includes all RBs of the initial UL BWP, or the active UL BWP is the initial UL BWP, the initial UL BWP is used

- else, the RB numbering starts from the first RB of the active UL BWP and the maximum number of RBs for frequency domain resource allocation equals the number of RBs in the initial UL BWP

The frequency domain resource allocation is by uplink resource allocation type 1 [6, TS 38.214]. For an initial UL BWP size of RBs, a UE processes the frequency domain resource assignment field as follows

- if , or for operation with shared spectrum channel access if

- truncate the frequency domain resource assignment field to its least significant bits and interpret the truncated frequency resource assignment field as for the frequency resource assignment field in DCI format 0\_0 as described in [5, TS 38.212]

- else

- insert most significant bits, or for operation with shared spectrum channel access insert most significant bits, with value set to '0' after the bits to the frequency domain resource assignment field, where if the frequency hopping flag is set to '0' and is provided in Table 8.3-1 if the hopping flag bit is set to '1', and interpret the expanded frequency resource assignment field as for the frequency resource assignment field in DCI format 0\_0 as described in [5, TS 38.212]

- end if

If *useInterlacePUCCH-PUSCH* is provided by *BWP-UplinkCommon* or *BWP-UplinkDedicated*, the frequency domain resource allocation is by uplink resource allocation type 2 [6, TS 38.214]. A UE processes the frequency domain resource assignment field as follows

- truncate the frequency domain resource assignment field to the LSBs if , or to the LSBs if

- for interlace allocation of a PUSCH transmission, interpret the MSBs of the truncated frequency domain resource assignment field for the active UL BWP as for the MSBs of the frequency domain resource assignment field in DCI format 0\_0 [6, TS 38.214]

- for RB set allocation of a PUSCH transmission, the RB set of the active UL BWP is the RB set of the PRACH transmission associated with the RAR UL grant. The UE assumes that the RB set is defined as when the UE is not provided *intraCellGuardBandsUL-List* [6, TS 38.214].

A UE determines whether or not to apply transform precoding as described in [6, TS 38.214].

For a PUSCH transmission with frequency hopping scheduled by RAR UL grant or for a Msg3 PUSCH retransmission, the frequency offset for the second hop [6, TS 38.214] is given in Table 8.3-1.

Table 8.3-1: Frequency offset for second hop of PUSCH transmission with frequency hopping scheduled by RAR UL grant or of Msg3 PUSCH retransmission

|  |  |  |
| --- | --- | --- |
| Number of PRBs in initial UL BWP | Value of Hopping Bits | Frequency offset for 2nd hop |
|  | 0 |  |
| 1 |  |
|  | 00 |  |
| 01 |  |
| 10 |  |
| 11 | Reserved |

A SCS for the PUSCH transmission is provided by *subcarrierSpacing* in *BWP-UplinkCommon*. A UE transmits PRACH and the PUSCH on a same uplink carrier of a same serving cell.

A UE transmits a transport block in a PUSCH scheduled by a RAR UL grant in a corresponding RAR message using redundancy version number 0, if the PUSCH transmission is without repetitions. If a TC-RNTI is provided by higher layers, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by TC-RNTI. Otherwise, the scrambling initialization of the PUSCH corresponding to the RAR UL grant in clause 8.2 is by C-RNTI.

Msg3 PUSCH retransmissions, if any, of the transport block, are scheduled by a DCI format 0\_0 with CRC scrambled by a TC-RNTI provided in the corresponding RAR message [11, TS 38.321].

With reference to slots for a PUSCH transmission scheduled by a RAR UL grant, if a UE receives a PDSCH with a RAR message ending in slot for a corresponding PRACH transmission from the UE, the UE transmits the PUSCH in slot , where and are provided in [6, TS 38.214] and is provided by *Koffset* in *ServingCellConfigCommon*; otherwise, if not provided, .

A UE can be provided in *RACH-ConfigCommon* a set of numbers of repetitions for a PUSCH transmission with PUSCH repetition Type A that is scheduled by a RAR UL grant or by a DCI format 0\_0 with CRC scrambled by a TC-RNTI. If the UE requests repetitions for the PUSCH transmission [11, TS 38.321], the UE transmits the PUSCH over slots, where is indicated by the 2 MSBs of the MCS field in the RAR UL grant or in the DCI format 0\_0 from a set of four values provided by *numberOfMsg3Repetitions*. The UE determines an MCS for the PUSCH transmission by the 2 LSBs of the MCS field in the RAR UL grant or by the 3 LSBs of the MCS field in the DCI format 0\_0, and determines a redundancy version and RBs for each repetition as described in [6, TS 38.214]. For unpaired spectrum operation, the UE determines the slots as the first slots starting from slot where a repetition of the PUSCH transmission does not include a symbol indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or indicated as a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*.

The UE may assume a minimum time between the last symbol of a PDSCH reception conveying a RAR message with a RAR UL grant and the first symbol of a corresponding PUSCH transmission scheduled by the RAR UL grant is equal to msec, where is a time duration of symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured, is a time duration of symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] and, for determining the minimum time, the UE considers that and correspond to the smaller of the SCS configurations for the PDSCH and the PUSCH. For , the UE assumes [6, TS 38.214].

\*\*\* Unchanged text is omitted \*\*\*

### 9.2.6 PUCCH repetition procedure

A UE can be indicated to transmit a PUCCH over slots using a PUCCH resource, where

- if the PUCCH resource is indicated by a DCI format and includes *PUCCH-nrofSlots*, is provided by *PUCCH-nrofSlots*

- otherwise, is provided by *nrofSlots*

If the UE is provided *subslotLengthForPUCCH*, a slot for a PUCCH transmission with repetitions over slots includes a number of symbols indicated by *subslotLengthForPUCCH*.

For ,

- the UE repeats the PUCCH transmission with the UCI over slots

- a repetition of the PUCCH transmission in each of the slots has a same number of consecutive symbols, as provided by *nrofSymbols*

- a repetition of the PUCCH transmission in each of the slots has a same first symbol, as provided by *startingSymbolIndex* if *subslotLengthForPUCCH* is not provided; otherwise mod(*startingSymbolIndex*, *subslotLengthForPUCCH*)

- the UE is configured by *interslotFrequencyHopping* whether or not to perform frequency hopping for repetitions of the PUCCH transmission in different slots

- if the UE is configured to perform frequency hopping for repetitions of a PUCCH transmission across slots and the UE is not provided *PUCCH-DMRS-Bundling* = ‘enabled’

- the UE performs frequency hopping per slot

- the UE transmits the PUCCH starting from a first PRB, provided by *startingPRB*, in slots with even number and starting from a second PRB, provided by *secondHopPRB*, in slots with odd number. The slot indicated to the UE for the first repetition of the PUCCH transmission has number 0 and each subsequent slot until the UE transmits the PUCCH in slots is counted regardless of whether or not the UE transmits the PUCCH in the slot

- the UE does not expect to be configured to perform frequency hopping for a repetition of the PUCCH transmission within a slot

- if the UE is configured to perform frequency hopping for repetitions of a PUCCH transmission across slots and the UE is provided *PUCCH-DMRS-Bundling* = ‘enabled’

- the UE performs frequency hopping per interval of consecutive slots, that start from a slot indicated to the UE for the first repetition of the PUCCH transmission, where is the value of *PUCCH-Frequencyhopping-Interval*, if provided; otherwise, is the value of *PUCCH-TimeDomainWindowLength*

- the UE transmits the PUCCH over intervals until the UE transmits the PUCCH in slots, where the first interval has number 0 and each subsequent interval is counted regardless of whether or not the UE transmits the PUCCH in a slot

- the UE transmits the PUCCH starting from a first PRB, provided by *startingPRB*, in intervals with even number and starting from a second PRB, provided by *secondHopPRB*, in intervals of frequency hopping intervals with odd number

- the UE does not expect to be configured to perform frequency hopping for a repetition of the PUCCH transmission within a slot

- if the UE is not configured to perform frequency hopping for repetitions of a PUCCH transmission across slots and the UE is configured to perform frequency hopping for a repetition of the PUCCH transmission within a slot, the frequency hopping pattern between the first PRB and the second PRB is same within each slot

If the UE determines that, for a repetition of a PUCCH transmission in a slot, the number of symbols available for the PUCCH transmission is smaller than the value provided by *nrofSymbols* for the corresponding PUCCH format, the UE does not transmit the PUCCH repetition in the slot.

A SS/PBCH block symbol is a symbol of an SS/PBCH block with candidate SS/PBCH block index corresponding to the SS/PBCH block index indicated to a UE by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon*, as described in clause 4.1.

For unpaired spectrum, the UE determines the slots for a PUCCH transmission starting from a slot indicated to the UE as described in clause 9.2.3 for HARQ-ACK reporting, or a slot determined as described in clause 9.2.4 for SR reporting or in clause 5.2.1.4 of [6, TS 38.214] for CSI reporting and having

- an UL symbol, as described in clause 11.1, or flexible symbol that is not SS/PBCH block symbol provided by *startingSymbolIndex* as a first symbol, and

- consecutive UL symbols, as described in clause 11.1, or flexible symbols that are not SS/PBCH block symbols, starting from the first symbol, equal to or larger than a number of symbols provided by *nrofsymbols*

For paired spectrum or supplementary uplink band, the UE determines the slots for a PUCCH transmission as the consecutive slots starting from a slot indicated to the UE as described in clause 9.2.3 for HARQ-ACK reporting, or a slot determined as described in clause 9.2.4 for SR reporting or in clause 5.2.1.4 of [6, TS 38.214] for CSI reporting.

If a UE would transmit a PUCCH over a first number of slots and the UE would transmit a PUSCH with repetition Type A or with TB processing over multiple slots over a second number of slots, and the PUCCH transmission would overlap with the PUSCH transmission in one or more slots, and the conditions in clause 9.2.5 for multiplexing the UCI in the PUSCH are satisfied in the overlapping slots, the UE transmits the PUCCH and does not transmit the PUSCH in the overlapping slots.

If a UE would transmit a PUCCH over a first number of slots and the UE would transmit a PUSCH with repetition Type B over a second number of slots, and the PUCCH transmission would overlap with actual PUSCH repetitions in one or more slots, and the conditions in clause 9.2.5 for multiplexing the UCI in the PUSCH are satisfied for the overlapping actual PUSCH repetitions, the UE transmits the PUCCH and does not transmit the overlapping actual PUSCH repetitions.

A UE does not multiplex different UCI types in a PUCCH transmission with repetitions over slots. If a UE would transmit a first PUCCH over more than one slot and at least a second PUCCH over one or more slots, and the transmissions of the first PUCCH and the second PUCCH would overlap in a number of slots then, for each slot of the number of slots and with UCI type priority of HARQ-ACK > SR > CSI with higher priority > CSI with lower priority

- the UE does not expect the first PUCCH and any of the second PUCCHs to start at a same slot and include a UCI type with same priority

- if the first PUCCH and any of the second PUCCHs include a UCI type with same priority, the UE transmits the PUCCH starting at an earlier slot and does not transmit the PUCCH starting at a later slot

- if the first PUCCH and any of the second PUCCHs do not include a UCI type with same priority, the UE transmits the PUCCH that includes the UCI type with higher priority and does not transmit the PUCCH that include the UCI type with lower priority

When a PUCCH resource used for repetitions of a PUCCH transmission by a UE includes first and second spatial settings, or first and second sets of power control parameters, as described in [11, TS 38.321] and in clause 7.2.1, the UE

- uses the first and second spatial settings, or the first and second sets of power control parameters, for first and second repetitions of the PUCCH transmission, respectively, when ,

- alternates between the first and second spatial settings, or between the first and second sets of power control parameters, respectively, per repetitions of the PUCCH transmission, where if *mappingPattern* = 'cyclicMapping'; else, .

A UE does not expect a PUCCH that is in response to a DCI format detection to overlap with any other PUCCH that does not satisfy the corresponding timing conditions in clause 9.2.5.

If a UE would transmit a PUCCH over slots and the UE does not transmit the PUCCH in a slot from the slots due to overlapping with another PUCCH transmission in the slot, the UE counts the slot in the number of slots.

For DAPS operation, if a UE would transmit a PUCCH over slots on the source MCG and the UE does not transmit the PUCCH in a slot from the slots due to overlapping in time with UE transmission on the target MCG in the slot, the UE counts the slot in the number of slots.