**3GPP TSG RAN WG1 #114** **R1-230xxxx**

**Toulouse, France, August 21st – 25th, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **17.6.0** |  |
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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:*** | Introduction of XR Enhancements for NR | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_XR\_enh-Core | | | | |  | ***Date:*** | | | 2023-09-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of XR enhancements for NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce support of XR enhancements for NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No support of XR enhancements for NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.3, 9, 9.3, 9.3.1 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | 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 parts are omitted \*\*\*

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in [1, TR 21.905].

\*\*\* Unchanged parts are omitted \*\*\*

TCI Transmission configuration indicator

TO Transmission occasion UCI Uplink control information

UE User equipment

UL Uplink

UL-SCH Uplink shared channel

USS UE-specific search space

UTO-UCI Unused transmission occasion - UCI

\*\*\* Unchanged parts are omitted \*\*\*

# 9 UE procedure for reporting control information

\*\*\* Unchanged parts are omitted \*\*\*

- if // this is for cases the UE supports multiplexing information of different priorities in a PUCCH/PUSCH transmission

- a PUCCH transmission with HARQ-ACK information, without repetitions, with smaller priority index overlaps with a PUCCH transmission only with HARQ-ACK information, without repetitions, with larger priority index, or

- a PUCCH transmission without repetitions that includes HARQ-ACK information of smaller priority index overlaps with a PUCCH transmission without repetitions using a PUCCH resource with PUCCH format 2/3/4 with HARQ-ACK information and SR of larger priority index, or

- a PUCCH transmission with HARQ-ACK information, without repetitions, with smaller or larger priority index overlaps, respectively, with a PUSCH transmission with larger or smaller priority index

the UE

- multiplexes HARQ-ACK information of different priority indexes and SR information of larger priority index, if any, in a same PUCCH transmission of larger priority index, or multiplexes HARQ-ACK information the UE would provide in a PUCCH transmission of smaller or larger priority index in a PUSCH transmission of larger or smaller priority index, respectively, and applies the procedures in clause 9.2.5.3 or 9.3, respectively, and

- drops CSI and/or SR carried in the PUCCH transmission of smaller priority index, if any

- drops negative SR carried in the PUCCH transmission of larger priority index, if any, if the UE would multiplex the HARQ-ACK information of larger priority index in a PUSCH transmission of smaller priority index

- drops HARQ-ACK information of smaller priority index if the UE would multiplex the HARQ-ACK information of smaller priority index in a PUSCH transmission where the UE multiplexes Part 1 CSI reports and Part 2 CSI reports of larger priority index

- drops Part 2 CSI reports of smaller priority index if the UE would multiplex the HARQ-ACK information of smaller and larger priority indexes in a PUSCH transmission where the UE multiplexes Part 1 CSI reports and Part 2 CSI reports of smaller priority index

- drops HARQ-ACK information of smaller priority index if the UE would multiplex the HARQ-ACK information of smaller priority index in a PUCCH transmission of larger priority index using a PUCCH resource provided by *n1PUCCH-AN*

- drops Part 2 CSI reports of smaller priority index if the UE would multiplex the HARQ-ACK information of larger priority index in a PUSCH transmission where the UE multiplexes CG-UCI, or UTO-UCI, Part 1 CSI reports and Part 2 CSI reports of smaller priority index

- else

- if the UE would transmit the following channels that would overlap in time where, if a channel transmission is with repetitions, the following are applicable per repetition

- a first PUCCH transmission of larger priority index and a second PUCCH transmission of smaller priority index

- a first PUCCH transmission of larger priority index and a second PUSCH transmission of smaller priority index when the UE cannot simultaneously transmit the first PUCCH and second PUSCH

- a first PUCCH transmission of smaller priority index and a second PUSCH transmission of larger priority index when the UE cannot simultaneously transmit the first PUCCH and second PUSCH

the UE

- transmits the PUCCH or the PUSCH of the larger priority index subject to the limitations for UE transmissions described in clauses 11.1, 11.1.1, 11.2A, and 15 and

- does not transmit a PUCCH or a PUSCH of smaller priority index

\*\*\* Unchanged parts are omitted \*\*\*

If a UE transmits a PUSCH with repetition Type B and the UE would transmit a PUCCH with HARQ-ACK and/or CSI information over a single slot that overlaps with the PUSCH transmission in one or more slots, the UE expects all actual repetitions of the PUSCH transmission [6, TS 38.214] that would overlap with the PUCCH transmission to fulfill the conditions in clause 9.2.5 for multiplexing the HARQ-ACK and/or CSI information, and the UE multiplexes the HARQ-ACK and/or CSI information in the earliest actual PUSCH repetition of the PUSCH transmission that would overlap with the PUCCH transmission and includes more than one symbol. The UE does not expect that all actual repetitions that would overlap with the PUCCH transmission do not include more than one symbol.

If the PUSCH transmission over the multiple slots is scheduled by a DCI format that includes a DAI field, the value of the DAI field is applicable for multiplexing HARQ-ACK information in the PUSCH transmission in any slot from the multiple slots where the UE multiplexes HARQ-ACK information.

When a UE would multiplex HARQ-ACK information in a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI [5, TS 38.212], the UE multiplexes the HARQ-ACK information in the PUSCH transmission if the UE is provided *cg-UCI-Multiplexing*; otherwise, if the HARQ-ACK information and the PUSCH have same priority index, the UE does not transmit the PUSCH and multiplexes the HARQ-ACK information in a PUCCH transmission or in another PUSCH transmission; if the HARQ-ACK information and the PUSCH have different priority indexes, the UE does not transmit the channel with the smaller priority index.

In the following, DCI formats with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI are also referred to as unicast DCI formats and DCI formats with CRC scrambled by G-RNTI for multicast or G-CS-RNTI are also referred to as multicast DCI formats. Corresponding unicast DCI formats are DCI formats 0\_0/0\_1/0\_2/1\_0/1\_1/1\_2 and multicast DCI formats are DCI formats 4\_1/4\_2 [4, TS 38.212]. PDSCH receptions scheduled by unicast or multicast DCI formats or HARQ-ACK information associated with unicast or multicast DCI formats are also respectively referred as unicast or multicast PDSCH receptions or unicast or multicast HARQ-ACK information.

\*\*\* Unchanged parts are omitted \*\*\*

## 9.3 UCI reporting in physical uplink shared channel

Offset values are defined for a UE to determine a number of resources for multiplexing HARQ-ACK information and for multiplexing CSI reports in a PUSCH. Offset values are also defined for multiplexing CG-UCI or UTO-UCI [5, TS 38.212] in a CG-PUSCH. The offset values are signalled to a UE either by a DCI format scheduling the PUSCH transmission or by higher layers.

If a DCI format that does not include a beta\_offset indicator field schedules the PUSCH transmission from the UE and the UE is provided *betaOffsets = 'semiStatic'* or *betaOffsetsDCI-0-2 = 'semiStaticDCI-0-2'*, the UE applies the , , and values that are provided by *betaOffsets = 'semiStatic'* for DCI formats 0\_0/0\_1 or by *betaOffsetsDCI-0-2 = 'semiStaticDCI-0-2'* for DCI format 0\_2 for the corresponding HARQ-ACK information, Part 1 CSI reports and Part 2 CSI reports. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *uci-MuxWithDiffPrio* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by *betaOffsetCrossPri1* *= 'semiStatic'* for DCI formats 0\_0/0\_1 and by *betaOffsetsCrossPri1DCI-0-2= 'semiStatic'* for DCI format 0\_2, or by *betaOffsetCrossPri0 = 'semiStatic'* for DCI format 0-1 and by *betaOffsetsCrossPri0DCI-0-2= 'semiStatic'* for DCI format 0\_2, respectively.

If the PUSCH transmission is with a configured grant and the UE is provided *CG-UCI-OnPUSCH= 'semiStatic'*, the UE applies the , , and values that are provided by *CG-UCI-OnPUSCH = 'semiStatic'* for the corresponding HARQ-ACK information, Part 1 CSI reports and Part 2 CSI reports. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *uci-MuxWithDiffPrio* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by *cg-betaOffsetsCrossPri1* *= 'semiStatic'* or *cg-betaOffsetsCrossPri0 = 'semiStatic'*, respectively.

If the PUSCH transmission is scheduled by DCI format 0\_0 and the UE is provided *betaOffsets = 'dynamic'*, the UE applies the , , and values that are determined from the first value of *betaOffsets = 'dynamic'*. If the UE is configured by *uci-MuxWithDiffPrio* to multiplex HARQ-ACK information of priority 1, the UE applies corresponding provided by the first value of *betaOffsetCrossPri1* *= 'dynamic'*.

If the PUSCH transmission is a configured grant Type 2 PUSCH and the UE is provided *CG-UCI-OnPUSCH* =*'dynamic'*, the UE applies the , , and values that are determined from the first value of *CG-UCI-OnPUSCH = 'dynamic'*. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *uci-MuxWithDiffPrio* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by the first value of *cg-betaOffsetsCrossPri1* *= 'dynamic'* or *cg-betaOffsetsCrossPri0* *= 'dynamic'*, respectively.

HARQ-ACK information offsets are configured to values according to Table 9.3-1. The *betaOffsetACK-Index1*, *betaOffsetACK-Index2*, and *betaOffsetACK-Index3* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 HARQ-ACK information bits, more than 2 and up to 11 HARQ-ACK information bits, and more than 11 bits in the PUSCH, respectively.

Offsets for multiplexing HARQ-ACK information with priority 0 in a PUSCH transmission with priority 1 are configured to values according to Table 9.3-1. The first, second and third values provided by any of *BetaOffsetsCrossPri0, betaOffsetsCrossPri0DCI-0-2, or* *cg-betaOffsetsCrossPri0* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 bits, more than 2 and up to 11 bits, and more than 11 bits of HARQ-ACK information with priority 0 in the PUSCH transmission with priority 1, respectively.

Offsets for multiplexing HARQ-ACK information with priority 1 in a PUSCH transmission with priority 0 are configured to values according to Table 9.3-1. The first, second and third values provided by any of *BetaOffsetsCrossPri1, betaOffsetsCrossPri1DCI-0-2, or* *cg-betaOffsetsCrossPri1* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 bits, more than 2 and up to 11 bits, and more than 11 bits of HARQ-ACK information with priority 1 in the PUSCH transmission with priority 0, respectively.

Part 1 CSI report and Part 2 CSI report offsets and , respectively, are configured to values according to Table 9.3-2. The *betaOffsetCSI-Part1-Index1* and *betaOffsetCSI-Part2-Index1* respectively provide indexes and for the UE to use if the UE multiplexes up to 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH. The *betaOffsetCSI-Part1-Index2* and *betaOffsetCSI-Part2-Index2* respectively provide indexes or for the UE to use if the UE multiplexes more than 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH.

If a DCI format that includes a beta\_offset indicator field with one bit or two bits, as configured by *UCI-OnPUSCH* for DCI format 0\_1 or by *UCI-OnPUSCH-DCI-0-2* for DCI format 0\_2, schedules the PUSCH transmission from the UE, the UE is provided by each of {*betaOffsetACK-Index1*, *betaOffsetACK-Index2*, *betaOffsetACK-Index3*}, the {first, second, third} values provided by *BetaOffsetsCrossPri0, or betaOffsetsCrossPri0DCI-0-2,* and the {first, second, third} values provided by *BetaOffsetsCrossPri1, or* *betaOffsetsCrossPri1DCI-0-2* a set of two or four indexes from Table 9.3-1 for multiplexing HARQ-ACK information in the PUSCH transmission and by each of {*betaOffsetCSI-Part1-Index1*, *betaOffsetCSI-Part1-Index2*} a set of two or four indexes, and by each of {*betaOffsetCSI-Part2-Index1*, *betaOffsetCSI-Part2-Index2*} a set of two or four indexes from Table 9.3-2, respectively, for multiplexing Part 1 CSI reports and Part 2 CSI reports, respectively, in the PUSCH transmission. The beta\_offset indicator field indicates a value and/or a value, and/or a value, a value and a value from the respective sets of values, with the mapping defined in Table 9.3-3 and in Table 9.3-3A. If the PUSCH transmission has priority 0 or priority 1, and the UE is provided *uci-MuxWithDiffPrio*, and the UE multiplexes HARQ-ACK information of priority 1 or priority 0 in the PUSCH, the UE applies the {first, second, third} values provided by *betaOffsetCrossPri1* *= 'dynamic'* for DCI format 0\_1, *betaOffsetsCrossPri1DCI-0-2= 'dynamic'* for DCI format 0\_2, or applies the {first, second, third} values provided by *betaOffsetCrossPri0 = 'dynamic'* for DCI format 0\_1, *betaOffsetsCrossPri0DCI-0-2= 'dynamic'* for DCI format 0\_2.

For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI, the UE multiplexes the CG-UCI in the PUSCH transmission using a value provided by *betaOffsetCG-UCI* with the mapping defined in Table 9.3-1. The CG-UCI has same priority value as the PUSCH. If the UE is provided *cg-UCI-Multiplexing* and multiplexes HARQ-ACK information of same priority value as the CG-UCI in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the CG-UCI [5, TS 38.212] and determines a number of resources for multiplexing the combined information in a PUSCH using which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.

For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes UTO-UCI, the UE multiplexes the UTO-UCI in the PUSCH transmission using a value provided by *betaOffsetUTO-UCI* with the mapping defined in Table 9.3-1. The UTO-UCI has same priority value as the PUSCH. If the UE multiplexes HARQ-ACK information of same priority value as the UTO-UCI in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the UTO-UCI and determines a number of resources for multiplexing the combined information in the PUSCH using which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.

Table 9.3-1: Mapping of beta\_offset values for HARQ-ACK information, CG-UCI, or UTO-UCI and the index signalled by higher layers

|  |  |
| --- | --- |
| or or or or  or or or  or or or | or or  or or |
| 0 | 1.000 |
| 1 | 2.000 |
| 2 | 2.500 |
| 3 | 3.125 |
| 4 | 4.000 |
| 5 | 5.000 |
| 6 | 6.250 |
| 7 | 8.000 |
| 8 | 10.000 |
| 9 | 12.625 |
| 10 | 15.875 |
| 11 | 20.000 |
| 12 | 31.000 |
| 13 | 50.000 |
| 14 | 80.000 |
| 15 | 126.000 |
| 16 | 0.6 |
| 17 | 0.4 |
| 18 | 0.2 |
| 19 | 0.1 |
| 20 | 0.05 |
| 21 | Reserved |
| 22 | Reserved |
| 23 | Reserved |
| 24 | Reserved |
| 25 | Reserved |
| 26 | Reserved |
| 27 | Reserved |
| 28 | Reserved |
| 29 | Reserved |
| 30 | Reserved |
| 31 | Reserved |

\*\*\* Unchanged parts are omitted \*\*\*

### 9.3.1 UE procedure for reporting UTO-UCI

If the UE is provided *nrof\_UTO\_UCI* with value equal to in *configuredGrantConfig* of a CG-PUSCH configuration, the UE multiplexes UTO-UCI represented by a bitmap of bits in each CG-PUSCH transmission for the CG-PUSCH configuration.

The bits of UTO-UCI, , have a one-to-one mapping to subsequent CG-PUSCH TOs in ascending order of start time. For unpaired spectrum operation, the subsequent CG-PUSCH TOs exclude invalid ones where a UE does not transmit a PUSCH based on the procedures in Clause 11.1. A bit value of ‘0’ indicates that the UE may transmit CG-PUSCH, and a bit value of ‘1’ indicates that the UE will not transmit CG-PUSCH, in a corresponding CG-PUSCH TO. When the UE indicates by UTO-UCI a value of ‘1’ for a CG-PUSCH TO, the UE continues to indicate the value of ‘1’ for the CG-PUSCH TO by UTO-UCI multiplexed in subsequent CG-PUSCH transmissions, and the UE does not transmit CG-PUSCH in the CG-PUSCH TO.