**3GPP TSG-RAN WG1 Meeting #108-e *R1-22xxxxx***

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

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.212** | **CR** |  | **rev** | **-** | **Current version:** | **17.0.0** |  |
|  | | | | | | | | |
| *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 |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Corrections on enhanced IIoT and URLLC in 38.212 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IIOT\_URLLC\_enh-Core | | | | |  | ***Date:*** | | | 2022-03-08 |
|  |  | | | |  | |  | | |  |
| ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Capture endorsed TP and agreements on HARQ-ACK enhancements and intra-UE multipelxing from RAN1#107b-e meeting and RAN1#108-e meeting. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Reflect agreement on multiplexing high-priority HARQ-ACK and low-priority HARQ-ACK on PUCCH Format 2. 2. Reflect agreement on multiplexing high-priority SR, high-priority HARQ-ACK and low-priority HARQ-ACK on PUCCH. 3. Reflect agreement on UCI with different priorities on PUSCH without UL-SCH. 4. Reflect agreement on multiplexing high-priority HARQ-ACK and low-priority HARQ-ACK on PUSCH with CSI including a single part. 5. Reflect agreement on HARQ-ACK enhancement related to DCI fields. 6. Capture text proposal 3-2 in section 1.1.1 of R1-2200692 for Clauses 7.3.1.1. 7. Reflect agreement on multiplexing HARQ-ACK of a single priority onto a PUSCH of a different priority. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The specification for Rel-17 enhanced IIoT and URLLC is incomplete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.3.3.1, 6.3.1, 6.3.1.1.4, 6.3.1.4.3, 6.3.1.4.4, 6.3.1.6, 6.3.2, 6.3.2.1.5, 6.3.2.4.1.6, 6.3.2.4.2.6, 6.3.2.7, 7.3.1.1.1, 7.3.1.2.2, 7.3.1.2.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.213, TS 37.213 | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

5.3.3.1 Encoding of 1-bit information

For , the code block is encoded according to Table 5.3.3.1-1, where  and  is the modulation order for the code block.

**Table 5.3.3.1-1: Encoding of 1-bit information**

|  |  |
| --- | --- |
|  | **Encoded bits** |
| **1** |  |
| 2 |  |
| 4 |  |
| 6 |  |
| 8 |  |

The "x" and "y" in Table 5.3.3.1-1 are placeholders for Clause 6.3.1.1, 6.3.2.5.1, 6.3.2.6.1 of [4, TS 38.211] to scramble the information bits in a way that maximizes the Euclidean distance of the modulation symbols carrying the information bits.

< Unchanged parts are omitted >

## 6.3 Uplink control information

### 6.3.1 Uplink control information on PUCCH

The procedure in this clause applies to PUCCH formats 2/3/4.

The following clauses 6.3.1.2, 6.3.1.3 and 6.3.1.5 apply regardless of whether the higher layer parameter *UCI-MuxWithDifferentPriority* is configured or not. The following clauses 6.3.1.1, 6.3.1.4 and 6.3.1.6 apply by assuming *UCI-MuxWithDifferentPriority* is not configured, or *UCI-MuxWithDifferentPriority* is configured and the UCIs for transmission on a PUCCH are of the same priority index, unless stated otherwise.

If the UE is configured with a PUCCH-SCell, *UCI-MuxWithDifferentPriority* is replaced by *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup* for the secondary PUCCH group in this clause*.*

#### 6.3.1.1 UCI bit sequence generation

< Unchanged parts are omitted >

##### 6.3.1.1.4 UCI with different priority indexes

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and SR associated with prioritiy index 1 if any are transmitted on a PUCCH, two UCI bit sequences are generated, and , according to the following, where and :

- the HARQ-ACK bits associated with priority index 1 are mapped to the UCI bit sequence , where for , the HARQ-ACK bit sequence is given by Clause 9.1 of [5, TS 38.213], and is the number of HARQ-ACK bits associated with priority index 1;

- if there is SR associated with priority index 1 for transmission on the PUCCH, set for , where the SR bit sequence is given by Clause 9.2.5.1 of [5, TS 38.213]; if there is no SR associated with priority index 1 for transmission on the PUCCH, set ;

- the HARQ-ACK bits associated with priority index 0 are mapped to the UCI bit sequence , where for , the HARQ-ACK bit sequence is given by Clause 9.1 of [5, TS 38.213], and is the number of HARQ-ACK bits associated with priority index 0.

< Unchanged parts are omitted >

#### 6.3.1.4 Rate matching

< Unchanged parts are omitted >

##### 6.3.1.4.3 UCI with different priority indexes encoded by Polar code

The following procedure in this clause 6.3.1.4.3 applies if *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and SR associated with prioritiy index 1 if any are transmitted on a PUCCH.

The input bit sequence to rate matching is where is the code block number, and is the number of coded bits in code block number.

Table 6.3.1.4.3-1: Rate matching output sequence length for UCIs with different priority indexes

|  |  |  |
| --- | --- | --- |
| UCIs for transmission on a PUCCH | UCI for encoding | Value of |
| HARQ-ACK of priority index 1, HARQ-ACK of priority index 0 | HARQ-ACK of priority index 1 |  |
| HARQ-ACK of priority index 0 |  |
| HARQ-ACK of priority index 1, SR of priority index 1, HARQ-ACK of priority index 0 | HARQ-ACK of priority index 1, SR of priority index 1 |  |
| HARQ-ACK of priority index 0 |  |

Rate matching is performed according to Clause 5.4.1 by setting and the rate matching output sequence length to , where is the number of code blocks for UCI determined according to Clause 6.3.1.2.1 and the value of is given by Table 6.3.1.4.3-1:

- is the number of bits for HARQ-ACK associated with priority index 1 for transmission on the current PUCCH;

- is the number of bits for SR associated with priority index 1 for transmission on the current PUCCH;

- if , =11; otherwise, is the number of CRC bits determined according to clause 6.3.1.2.1, where equals for the case of "HARQ-ACK of priority index 1, HARQ-ACK of priority index 0", and equals for the case of "HARQ-ACK of priority index 1, SR of priority index 1, HARQ-ACK of priority index 0" respectively in Table 6.3.1.4.3-1;

- is the configured maximum PUCCH coding rate of priority index 1;

- is given by Table 6.3.1.4-1.

The output bit sequence after rate matching is denoted as where is the length of rate matching output sequence in code block number.

##### 6.3.1.4.4 UCI with different priority indexes encoded by channel coding of small block lengths

The following procedure in this clause 6.3.1.4.4 applies if *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and SR associated with prioritiy index 1 if any are transmitted on a PUCCH.

The input bit sequence to rate matching is .

The value of is determined according to Table 6.3.1.4.3-1 by setting =0.

Rate matching is performed according to Clause 5.4.3 by setting the rate matching output sequence length .

The output bit sequence after rate matching is denoted as .

< Unchanged parts are omitted >

#### 6.3.1.6 Multiplexing of coded UCI bits to PUCCH

If CSI of two parts or UCIs with different priority indexes are transmitted on a PUCCH, the coded bits corresponding to UCI bit sequence  is denoted by and the coded bits corresponding to UCI bit sequence  is denoted by .

For PUCCH format 2 when *UCI-MuxWithDifferentPriority* is configured, the coded bit sequence is generated for UCIs with different priority indexes by setting for , and setting for .

For PUCCH format 3/4, the coded bit sequence , where , is generated according to the following.

Table 6.3.1.6-1: PUCCH DMRS and UCI symbols

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PUCCH duration (symbols) | PUCCH DMRS symbol indices | Number of UCI symbol indices sets | 1st UCI symbol indices set | 2nd UCI symbol indices set | 3rd UCI symbol indices set |
| 4 | {1} | 2 | {0,2} | {3} | - |
| 4 | {0,2} | 1 | {1,3} | - | - |
| 5 | {0, 3} | 1 | {1, 2, 4} | - | - |
| 6 | {1, 4} | 1 | {0, 2, 3, 5} | - | - |
| 7 | {1, 4} | 2 | {0, 2, 3, 5} | {6} | - |
| 8 | {1, 5} | 2 | {0, 2, 4, 6} | {3, 7} | - |
| 9 | {1, 6} | 2 | {0, 2, 5, 7} | {3, 4, 8} | - |
| 10 | {2, 7} | 2 | {1, 3, 6, 8} | {0, 4, 5, 9} | - |
| 10 | {1, 3, 6, 8} | 1 | {0,2,4,5,7,9} | - | - |
| 11 | {2, 7} | 3 | {1,3,6,8} | {0,4,5,9} | {10} |
| 11 | {1,3,6,9} | 1 | {0,2,4,5,7,8,10} | - | - |
| 12 | {2, 8} | 3 | {1,3,7,9} | {0,4,6,10} | {5, 11} |
| 12 | {1,4,7,10} | 1 | {0,2,3,5,6,8,9,11} | - | - |
| 13 | {2, 9} | 3 | {1,3,8,10} | {0,4,7,11} | {5,6,12} |
| 13 | {1,4,7,11} | 2 | {0,2,3,5,6,8,10,12} | {9} | - |
| 14 | {3, 10} | 3 | {2,4,9,11} | {1,5,8,12} | {0,6,7,13} |
| 14 | {1,5,8,12} | 2 | {0,2,4,6,7,9,11,13} | {3, 10} | - |

Denote  as UCI OFDM symbol index. Denote  as the number of elements in UCI symbol indices set  for , where  and  are given by Table 6.3.1.6-1 according to the PUCCH duration and the PUCCH DMRS configuration. Denote  as the number of OFDM symbols carrying UCI in the PUCCH. Denote  as the modulation order of the PUCCH.

For PUCCH format 3, set , where  is the number of PRBs that is determined by the UE for PUCCH format 3 transmission according to Clause 9.2 of [5, TS 38.213], and is the spreading factor for PUCCH format 3 [4, TS 38.211].

For PUCCH format 4, set , where  is the spreading factor for PUCCH format 4.

Find the smallest such that .

Set ;

Set ;

Set ;

Set ;

for  to 

if 

for  to 

for  to 

;

;

end for

end for

elseif 

if 

;

else

;

end if

;

for  to 

for  to 

;

;

end for

end for

for  to 

for  to 

;

;

end for

end for

else

for  to 

for  to 

;

;

end for

end for

end if

end for

Set 

for  to 

for  to 

for  to 

;

;

end for

end for

end for

< Unchanged parts are omitted >

### 6.3.2 Uplink control information on PUSCH

The following clauses 6.3.2.2, 6.3.2.3, and 6.3.2.5 apply regardless of whether the higher layer parameter *UCI-MuxWithDifferentPriority* is configured or not. The following clauses 6.3.2.1, 6.3.2.4, and 6.3.2.6 apply by assuming *UCI-MuxWithDifferentPriority* is not configured, or *UCI-MuxWithDifferentPriority* is configured and the UCIs for transmission on a PUSCH are of the same priority index, unless stated otherwise. In addition, clauses 6.3.2.1.4, 6.3.2.4.1.5, 6.3.2.4.2.5 and 6.3.2.6 also apply if *UCI-MuxWithDifferentPriority* is configured and CG-UCI is of a different priority index with HARQ-ACK.

If the UE is configured with a PUCCH-SCell, *UCI-MuxWithDifferentPriority* is replaced by *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup* for the secondary PUCCH group in this clause*.*

#### 6.3.2.1 UCI bit sequence generation

< Unchanged parts are omitted >

##### 6.3.2.1.5 UCI with different priority indexes

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, and CSI part 1 if any are transmitted on a PUSCH associated with priority index 1, the following UCI bit sequences are generated, , and if any, according to the following:

- If CSI part 1 is also transmitted on the PUSCH,

- Set for as the bit sequence of CSI part 1, where the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-6, are mapped to the UCI bit sequence starting with .

- Set for and , where the HARQ-ACK bit sequence associated with priority index 0 is given by Clause 9.1 of [5, TS 38.213].

- Otherwise, set for and , where the HARQ-ACK bit sequence associated with priority index 0 is given by Clause 9.1 of [5, TS 38.213].

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 1, and CSI if any are transmitted on a PUSCH associated with priority index 0, the following UCI bit sequences are generated,, if any, and if any, according to the following:

- If HARQ-ACK bits associated with priority index 1 and CSI are transmitted on the PUSCH without UL-SCH and the CSI includes CSI part 1 without CSI part 2, and there is only one HARQ-ACK bit associated with priority index 1 given by Clause 9.1 of [5, TS 38.213], set , , and ; otherwise, set for and , where the HARQ-ACK bit sequence associated with priority index 1 is given by Clause 9.1 of [5, TS 38.213];

- Set for as the bit sequence of CSI part 1, if CSI part 1 is also transmitted on the PUSCH, where the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-6, are mapped to the UCI bit sequence starting with ;

- Set for as the bit sequence of CSI part 2, if CSI part 2 is also transmitted on the PUSCH, where the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-7, are mapped to the UCI bit sequence starting with .

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH, the following UCI bit sequences are generated,, , and if any, according to the following:

- Set for and , where the HARQ-ACK bit sequence associated with priority index 1 is given by Clause 9.1 of [5, TS 38.213];

- If CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1,

- Set for as the bit sequence of CSI part 1, where the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-6, are mapped to the UCI bit sequence starting with .

- Set for and , where the HARQ-ACK bit sequence associated with priority index 0 is given by Clause 9.1 of [5, TS 38.213].

- Otherwise,

- Set for and , where the HARQ-ACK bit sequence associated with priority index 0 is given by Clause 9.1 of [5, TS 38.213].

- Set for and , if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0, where the CSI part 1 sequence is given by Table 6.3.2.1.2-6 by replacing , and the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-6, are mapped to the CSI part 1 sequence starting with .

< Unchanged parts are omitted >

#### 6.3.2.4 Rate matching

##### 6.3.2.4.1 UCI encoded by Polar code

< Unchanged parts are omitted >

###### 6.3.2.4.1.6 UCI with different priority indexes

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, and CSI part 1 if any are transmitted on a PUSCH associated with priority index 1:

- If CSI part 1 is also transmitted on the PUSCH,

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.1.2, by assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.1.2 is 0 bit.

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.1.3, by taking HARQ-ACK with priority index 0 as CSI part 2 and replacing by , and assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.1.3 is 0 bit.

- Otherwise, perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.1.2, by taking HARQ-ACK with priority index 0 as CSI-part 1 and replacing by , and assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.1.2 is 0 bit.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 1, and CSI if any are transmitted on a PUSCH associated with priority index 0:

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.1.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.1.2, by taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH.

- Perform rate matching for CSI part 2 according to clause 6.3.2.4.1.3, by taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 2 is also transmitted on the PUSCH.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH:

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.1.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

- If CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1,

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.1.2, by taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.1.3, by taking HARQ-ACK with priority index 0 as CSI part 2 and replacing by , and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Otherwise,

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.1.2, by taking HARQ-ACK with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.1.3, by taking CSI part 1 as CSI part 2 and replacing by , taking HARQ-ACK with priority index 0 as CSI-part 1 and taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0.

< Unchanged parts are omitted >

##### 6.3.2.4.2 UCI encoded by channel coding of small block lengths

< Unchanged parts are omitted >

###### 6.3.2.4.2.6 UCI with different priority indexes

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, and CSI part 1 if any are transmitted on a PUSCH associated with priority index 1:

- If CSI part 1 is also transmitted on the PUSCH,

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.2, by assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.2.2 is 0 bit.

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.3, by taking HARQ-ACK with priority index 0 as CSI part 2 and replacing by , and assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.2.3 is 0 bit.

- Otherwise, perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 0 as CSI-part 1 and replacing by , and assuming the number of HARQ-ACK information bits to be transmitted on PUSCH in clause 6.3.2.4.2.2 is 0 bit.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 1, and CSI if any are transmitted on a PUSCH associated with priority index 0:

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH.

- Perform rate matching for CSI part 2 according to clause 6.3.2.4.2.3, by taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 2 is also transmitted on the PUSCH.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH:

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

- If CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1,

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.3, by taking HARQ-ACK with priority index 0 as CSI part 2 and replacing by , and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Otherwise,

- Perform rate matching for HARQ-ACK with priority index 0 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.3, by taking CSI part 1 as CSI part 2 and replacing by , taking HARQ-ACK with priority index 0 as CSI-part 1 and taking HARQ-ACK with priority index 1 as HARQ-ACK, if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0.

< Unchanged parts are omitted >

#### 6.3.2.7 Multiplexing of coded UCI bits with different priority indexes to PUSCH

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, and CSI part 1 if any are transmitted on a PUSCH associated with priority index 1,

- If CSI part 1 is also transmitted on the PUSCH, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 0 as CSI part 2, and assuming the number of HARQ-ACK information in Clause 6.2.7 is 0 bit;

- Otherwise, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 0 as CSI-part 1, and assuming the number of HARQ-ACK information in Clause 6.2.7 is 0 bit.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 1, and CSI if any are transmitted on a PUSCH associated with priority index 0, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 as HARQ-ACK.

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a PUSCH,

- if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 1, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 as HARQ-ACK, and taking HARQ-ACK with priority index 0 as CSI part 2;

- otherwise, the coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7 by taking HARQ-ACK with priority index 1 as HARQ-ACK and taking HARQ-ACK with priority index 0 as CSI part 1, and taking CSI part 1 as CSI part 2 if CSI part 1 is also transmitted on the PUSCH and the PUSCH is associated with priority index 0.

< Unchanged parts are omitted >

### 7.3.1 DCI formats

< Unchanged parts are omitted >

7.3.1.1 DCI formats for scheduling of PUSCH

7.3.1.1.1 Format 0\_0

< Unchanged parts are omitted >

**Table** **7.3.1.1.1-4A: Channel access type & CP extension if *ChannelAccessMode-r16* = "*semistatic*" is provided**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bit field mapped to index** | **Channel Access Type** | **The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211]** | **Initiator of the channel occupancy associated with the UL transmission as described in Clause x.x in TS 37.213** |
| 0 | No sensing as defined in Clause 4.3 in TS 37.213 | 0 | gNB |
| 1 | No sensing as defined in Clause 4.3 in TS 37.213 | 2 | gNB |
| 2 | Sensing within a 25us interval as defined in Clause 4.3 in TS 37.213 | 0 | gNB |
| 3 | Sensing as defined in Clause 4.3.1.2 in TS 37.213 | 0 | UE |
| Note: Row index 3 is only applicable if *ue-SemiStaticChannelAccessConfig* is provided. Otherwise, the row is reserved. | | | |

< Unchanged parts are omitted >

#### 7.3.1.2 DCI formats for scheduling of PDSCH

< Unchanged parts are omitted >

7.3.1.2.2 Format 1\_1

DCI format 1\_1 is used for the scheduling of one or multiple PDSCH in one cell.

The following information is transmitted by means of the DCI format 1\_1 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bits

- The value of this bit field is always set to 1, indicating a DL DCI format

< Unchanged parts are omitted >

- PDSCH-to-HARQ\_feedback timing indicator – 0, 1, 2, or 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *dl-DataToUL-ACK.*

If higher layer parameter *priorityIndicatorDCI-1-1* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 for the other HARQ-ACK codebook on the same cell for PUCCH transmission, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 for the two HARQ-ACK codebooks are the same.

If higher layer parameter *pucch-sSCellDyn* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 associated with one cell for PUCCH transmission is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 associated with the other cell for PUCCH transmision, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 associated with the two cells are the same.

If the UE is configured with a PUCCH-SCell, *pucch-sSCellDyn* is replaced by *pucch-sSCellDyn-secondaryPUCCHgroup* for the secondary PUCCH group*.*

- One-shot HARQ-ACK request – 0 or 1 bit.

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedback-r16* or *pdsch-HARQ-ACK-enhType3List* is configured;

- 0 bit otherwise.

- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.

- 0 bit if *pdsch-HARQ-ACK-enhType3DCIfield* is not configured;

- bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.*

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-enhType3DCIfield* is replaced by *pdsch-HARQ-ACK-enhType3DCIfield-secondaryPUCCHgroup* for the secondary PUCCH group, and *pdsch-HARQ-ACK-enhType3List* is replaced by *pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup* for the secondary PUCCH group*.*

- PDSCH group index – 0 or 1 bit.

- 1 bit if the higher layer parameter *pdsch-HARQ-ACK-Codebook-r16=* *enhancedDynamic*;

- 0 bit otherwise.

- New feedback indicator – 0, 1 or 2 bits.

- 1 bit if the higher layer parameter *pdsch-HARQ-ACK-Codebook-r16=* *enhancedDynamic* and the higher layer parameter *nfi-TotalDAI-Included* is not configured;

- 2 bits if the higher layer parameter *pdsch-HARQ-ACK-Codebook-r16=* *enhancedDynamic* and the higher layer parameter *nfi-TotalDAI-Included=true*; the MSB corresponds to the scheduled PDSCH group, and the LSB corresponds to the non-scheduled PDSCH group, as defined in [TS38.213] clause 9.1.3.3

- 0 bit otherwise.

- Number of requested PDSCH group(s) – 0 or 1 bit.

- 1 bit if the higher layer parameter *pdsch-HARQ-ACK-Codebook-r16=* *enhancedDynamic*;

- 0 bit otherwise.

- HARQ-ACK retransmission indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-retx* is configured.

- 0 bit otherwise.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-retx* is replaced by *pdsch-HARQ-ACK-retx-secondaryPUCCHgroup* for the secondary PUCCH group.

< Unchanged parts are omitted >

- PUCCH Cell indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *pucch-sSCellDyn* is configured.

- 0 bit otherwise.

If DCI formats 1\_1 are monitored in multiple search spaces associated with multiple CORESETs in a BWP for scheduling the same serving cell, zeros shall be appended until the payload size of the DCI formats 1\_1 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_1 monitored in the multiple search spaces.

< Unchanged parts are omitted >

##### 7.3.1.2.3 Format 1\_2

DCI format 1\_2 is used for the scheduling of PDSCH in one cell.

The following information is transmitted by means of the DCI format 1\_2 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bits

- The value of this bit field is always set to 1, indicating a DL DCI format.

< Unchanged parts are omitted >

- PDSCH-to-HARQ\_feedback timing indicator – 0, 1, 2, or 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *DL-DataToUL-ACK-DCI-1-2.*

If higher layer parameter *priorityIndicatorDCI-1-2* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for the other HARQ-ACK codebook on the same cell for PUCCH transmission, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 for the two HARQ-ACK codebooks are the same.

If higher layer parameter *pucch-sSCellDynDCI-1-2* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 associated with one cell for PUCCH transmission is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 associated with the other cell for PUCCH transmision, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_2 associated with the two cells are the same.

- One-shot HARQ-ACK request –0 or 1 bit.

- 1 bit if higher layer parameter pdsch-HARQ-ACK-OneShotFeedbackDCI-1-2 or pdsch-HARQ-ACK-enhType3DCI-1-2 is configured;

- 0 bit otherwise.

- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.

- 0 bit if *pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2* is not configured;

- bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.*

If the UE is configured with a PUCCH-SCell, pdsch-HARQ-ACK-enhType3DCIfield is replaced by pdsch-HARQ-ACK-enhType3DCIfield-secondaryPUCCHgroup for the secondary PUCCH group, and pdsch-HARQ-ACK-enhType3List is replaced by pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup for the secondary PUCCH group.

- HARQ-ACK retransmission indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-retxDCI-1-2* is configured.

- 0 bit otherwise.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-retxDCI-1-2* is replaced by *pdsch-HARQ-ACK-retxDCI-1-2-secondaryPUCCHgroup* for the secondary PUCCH group.

- Antenna port(s) – 0, 4, 5, or 6 bits

- 0 bit if higher layer parameter *antennaPortsFieldPresenceDCI-1-2* is notconfigured;

- Otherwise 4, 5 or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4, where the number of CDM groups without data of values 1, 2, and 3 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively. The antenna ports shall be determined according to the ordering of DMRS port(s) given by Tables 7.3.1.2.2-1/2/3/4. If a UE is configured with both *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* andis configured with higher layer parameter *antennaPortsFieldPresenceDCI-1-2*, the bitwidth of this field equals, where is the "Antenna ports" bitwidth derived according to *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and is the "Antenna ports" bitwidthderived according to *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2*. A number of zeros are padded in the MSB of this field, if the mapping type of the PDSCH corresponds to the smaller value of and .

If a UE is not configured with higher layer parameter *antennaPortsFieldPresenceDCI-1-2*, antenna port(s) are defined assuming bit field index value 0 in Tables 7.3.1.2.2-1/2/3/4.

< Unchanged parts are omitted >