**3GPP TSG-RAN WG1 Meeting #107-e *R1-211xxxx***

**e-Meeting, November 11–19, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.212** | **CR** |  | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  | | | | | | | | |
| *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 |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of Rel-17 enhanced IIoT and URLLC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IIOT\_URLLC\_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 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Inclusion of Rel-17 enhanced IIoT and URLLC. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Support of Rel-17 enhanced IIoT and URLLC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | enhanced IIoT and URLLC in Rel-17 will be incomplete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3.1, 6.3.1.1.2, 6.3.1.1.4(new), 6.3.1.4.3(new), 6.3.1.4.4(new), 6.3.1.6, 6.3.2, 6.3.2.1.2, 6.3.2.1.3, 6.3.2.1.5(new), 6.3.2.4.1.6(new), 6.3.2.4.2.6(new), 6.3.2.7(new), 7.3.1.1.1, 7.3.1.1.2, 7.3.1.1.3, 7.3.1.2.2, 7.3.1.2.3, 7.3.1.3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.213, TS 38. 214 | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## 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 subclauses 6.3.1.2, 6.3.1.3, 6.3.1.5 and 6.3.1.6 apply regardless of whether the higher layer parameter *UCI-MuxWithDifferentPriority* is configured or not. The following subclauses 6.3.1.1, and 6.3.1.4 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.

#### 6.3.1.1 UCI bit sequence generation

< Unchanged parts are omitted >

##### 6.3.1.1.2 CSI only

If *cqi-BitsPerSubband* is configured, this Clause 6.3.1.1.2 applies by taking Subband CQI as Subband differential CQI and replacing the corresponding number of bits 2 by 4.

The bitwidth for PMI of *codebookType=typeI-SinglePanel* with 2 CSI-RS ports is 2 for Rank=1 and 1 for Rank=2, according to Clause 5.2.2.2.1 in [6, TS 38.214].

The bitwidth for PMI of *codebookType=typeI-SinglePanel* with more than 2 CSI-RS ports is provided in Tables 6.3.1.1.2-1, where the values of ****and **** are given by Clause 5.2.2.2.1 in [6, TS 38.214].

< Unchanged parts are omitted >

##### 6.3.1.1.4 HARQ-ACK only with different priority indexes

If *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0 and HARQ-ACK bits associated with priority index 1 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;

- 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 subclause 6.3.1.4.3 applies for PUCCH formats 3/4 if *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0 and HARQ-ACK bits associated with priority index 1 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 |  |

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;

- 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" 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 subclause 6.3.1.4.4 applies for PUCCH formats 3/4 if *UCI-MuxWithDifferentPriority* is configured, and HARQ-ACK bits associated with priority index 0 and HARQ-ACK bits associated with priority index 1 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 with PUCCH formats 3/4, the coded bits corresponding to UCI bit sequence  is denoted by and the coded bits corresponding to UCI bit sequence  is denoted by . The coded bit sequence , where , is generated according to the following.

< Unchanged parts are omitted >

### 6.3.2 Uplink control information on PUSCH

The following subclauses 6.3.2.2, 6.3.2.3, and 6.3.2.5 apply regarless of whether the higher layer parameter *UCI-MuxWithDifferentPriority* is configured or not. The following subclauses 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, subclauses 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, HARQ-ACKs are of the same priority index, and CG-UCI is of a different priority index with HARQ-ACK.

#### 6.3.2.1 UCI bit sequence generation

< Unchanged parts are omitted >

##### 6.3.2.1.2 CSI

If *cqi-BitsPerSubband* is configured, this Clause 6.3.2.1.2 applies by taking Subband CQI as Subband differential CQI and replacing the corresponding number of bits 2 by 4.

The bitwidth for PMI of *codebookType=typeI-SinglePanel* and *codebookType=typeI-MultiPanel* is specified in Clause 6.3.1.1.2.

The bitwidth for RI/LI/CQI/CRI of *codebookType=typeI-SinglePanel* and *codebookType=typeI-MultiPanel* is specified in Clause 6.3.1.1.2.

The bitwidth for PMI of *codebookType=typeII* is provided in Tables 6.3.2.1.2-1, where the values of , , , , , , and  are given by Clause 5.2.2.2.3 in [6, TS 38.214].

< Unchanged parts are omitted >

##### 6.3.2.1.3 CG-UCI

For CG-UCI bits transmitted on a CG PUSCH when the higher layer parameter *cg-RetransmissionTimer* is configured, the CG-UCI bit sequence is determined as follows:

- set for and , where the CG-UCI bit sequence is given by Table 6.3.2.1.3-1, mapped in the order from upper part to lower part.

Table 6.3.2.1.3-1: Mapping order of CG-UCI fields

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| HARQ process number | 4 |
| Redundancy version | 2 |
| New data indicator | 1 |
| Channel Occupancy Time (COT) sharing information | if both higher layer parameter *ul-toDL-COT-SharingED-Threshold* and higher layer parameter *cg-COT-SharingList* are configured, or if both higher layer parameter *ue-SemiStaticChannelAccessConfig* and higher layer parameter *cg-COT-SharingList* are configured, where *C* is the number of combinations configured in *cg-COT-SharingList;*  1 if higher layer parameter *ul-toDL-COT-SharingED-Threshold* is not configured, and if higher layer parameter *ue-SemiStaticChannelAccessConfig* is not configured, and if higher layer parameter *cg-COT-SharingOffset* is configured;  0 otherwise;  If a UE indicates COT sharing other than "no sharing" in a CG PUSCH within the UE's initiated COT, the UE should provide consistent COT sharing information in all the subsequent CG PUSCHs, if any, occurring within the same UE's initiated COT such that the same DL starting point and duration are maintained. |

< 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, 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 is given by Clause 9.1 of [5, TS 38.213];

- Set for and , where the HARQ-ACK bit sequence 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 with UL-SCH, 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, 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 subclause 6.3.2.4.1.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

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

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

< 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, 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 subclause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

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

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

< 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, HARQ-ACK bits associated with priority index 1, and CSI part 1 if any are transmitted on a 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 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 with UL-SCH.

< 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 | 9us sensing within a 25us interval as defined in Clause 4.3 in TS 37.213 | 0 | gNB |
| 3 | 9us sensing as defined in Clause x.x in TS 37.213 | 0 | UE |

Note: Row index 3 is only applicable if *ue-SemiStaticChannelAccessConfig* is provided.

< Unchanged parts are omitted >

7.3.1.1.2 Format 0\_1

DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback information (CG-DFI) to a UE.

The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Carrier indicator – 0 or 3 bits, as defined in Clause 10.1 of [5, TS38.213].

- DFI flag – 0 or 1 bit

- 1 bit if the UE is configured to monitor DCI format 0\_1 with CRC scrambled by CS-RNTI and for operation in a cell with shared spectrum channel access when the higher layer parameter *cg-RetransmissionTimer* is configured. For a DCI format 0\_1 with CRC scrambled by CS-RNTI, the bit value of 0 indicates activating or releasing type 2 CG transmission and the bit value of 1 indicates CG-DFI. For a DCI format 0\_1 with CRC scrambled by C-RNTI/SP-CSI-RNTI/MCS-C-RNTI and for operation in a cell with shared spectrum channel access, the bit is reserved.

- 0 bit otherwise;

If DCI format 0\_1 is used for indicating CG-DFI, all the remaining fields are set as follows:

- HARQ-ACK bitmap – 16 bits , where the order of the bitmap to HARQ process index mapping is such that HARQ process indices are mapped in ascending order from MSB to LSB of the bitmap. For each bit of the bitmap, value 1 indicates ACK, and value 0 indicates NACK.

- TPC command for scheduled PUSCH – 2 bits as defined in Clause 7.1.1 of [5, TS38.213]

- All the remaining bits in format 0\_1 are set to zero.

Otherwise, all the remaining fields are set as follows:

< Unchanged parts are omitted >

**Table** **7.3.1.1.2-35: Allowed entries for DCI format 0\_1 and DCI format 0\_2, configured by higher layer parameter *ul-AccessConfigListDCI-0-1* and *ul-AccessConfigListDCI-0-2*, respectively**

|  |  |  |  |
| --- | --- | --- | --- |
| **Entry index** | **Channel Access Type** | **The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, 38.211]** | **CAPC** |
| 0 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 1 |
| 1 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 2 |
| 2 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 3 |
| 3 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 4 |
| 4 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 1 |
| 5 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 2 |
| 6 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 3 |
| 7 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 4 |
| 8 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 1 |
| 9 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 2 |
| 10 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 3 |
| 11 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 | 4 |
| 12 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 1 |
| 13 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 2 |
| 14 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 3 |
| 15 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 | 4 |
| 16 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 0 | 1 |
| 17 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 0 | 2 |
| 18 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 0 | 3 |
| 19 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 0 | 4 |
| 20 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 | 1 |
| 21 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 | 2 |
| 22 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 | 3 |
| 23 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 | 4 |
| 24 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 | 1 |
| 25 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 | 2 |
| 26 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 | 3 |
| 27 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 | 4 |
| 28 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 | 1 |
| 29 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 | 2 |
| 30 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 | 3 |
| 31 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 | 4 |
| 32 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 1 | 1 |
| 33 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 1 | 2 |
| 34 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 1 | 3 |
| 35 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 1 | 4 |
| 36 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 2 | 1 |
| 37 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 2 | 2 |
| 38 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 2 | 3 |
| 39 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 2 | 4 |
| 40 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 3 | 1 |
| 41 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 3 | 2 |
| 42 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 3 | 3 |
| 43 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 3 | 4 |

7.3.1.1.3 Format 0\_2

DCI format 0\_2 is used for the scheduling of PUSCH in one cell.

The following information is transmitted by means of the DCI format 0\_2 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Carrier indicator – 0, 1, 2 or 3 bits determined by higher layer parameter *carrierIndicatorSizeDCI-0-2*, as defined in Clause 10.1 of [5, TS38.213].

< Unchanged parts are omitted >

- DMRS sequence initialization – 0 or 1 bit

- 0 bit if the higher layer parameter *dmrs-SequenceInitializationDCI-0-2* is not configured or if transform precoder is enabled;

- 1 bit if transform precoder is disabled and the higher layer parameter *dmrs-SequenceInitializationDCI-0-2* is configured.

- UL-SCH indicator – 1 bit. A value of "1" indicates UL-SCH shall be transmitted on the PUSCH and a value of "0" indicates UL-SCH shall not be transmitted on the PUSCH. Except for DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, a UE is not expected to receive a DCI format 0\_2 with UL-SCH indicator of "0" and CSI request of all zero(s).

- ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-2* or in Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 are configured by the higher layer parameter *ul-AccessConfigListDCI-0-2.*

- Open-loop power control parameter set indication – 0 or 1 or 2 bits.

- 0 bit if the higher layer parameter *p0-PUSCH-SetList* is not configured;

- 1 or 2 bits otherwise,

- 1 bit if SRS resource indicator is present in the DCI format 0\_2;

- 1 or 2 bits as determined by higher layer parameter *olpc-ParameterSetDCI-0-2* if SRS resource indicator is not present in the DCI format 0\_2;

< Unchanged parts are omitted >

7.3.1.2.2 Format 1\_1

DCI format 1\_1 is used for the scheduling of 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.

- 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* if present for the secondary PUCCH group, and *pdsch-HARQ-ACK-enhType3List* is replaced by *pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup* if present 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* if present for the secondary PUCCH group.

- Cross priority multiplexing indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *dynaIndicationOfCrossPriMux* is configured.

- 0 bit otherwise.

< Unchanged parts are omitted >

- SCell dormancy indication – 0 bit if higher layer parameter *dormancyGroupWithinActiveTime* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *dormancyGroupWithinActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupWithinActiveTime,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an SCell.

If one-shot HARQ-ACK request is not present or set to '0', and all bits of frequency domain resource assignment are set to 0 for resource allocation type 0 or set to 1 for resource allocation type 1 or set to 0 or 1 for dynamic switch resource allocation type, this field is reserved and the following fields among the fields above are used for SCell dormancy indication, where each bit corresponds to one of the configured SCell(s), with MSB to LSB of the following fields concatenated in the order below corresponding to the SCell with lowest to highest SCell index

- Modulation and coding scheme of transport block 1

- New data indicator of transport block 1

- Redundancy version of transport block 1

- HARQ process number

- Antenna port(s)

- DMRS sequence initialization

- 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 >

**Table 7.3.1.2.2-6: Allowed entries for DCI format 1\_1 and DCI format 1\_2, configured by higher layer parameter *ul-AccessConfigListDCI-1-1* and *ul-AccessConfigListDCI-1-2*, respectively**

|  |  |  |
| --- | --- | --- |
| **Entry index** | **Channel Access Type** | **The CP extension Text index defined in Clause 5.3.1 of [4, TS 38.211]** |
| 0 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 |
| 1 | Type2C-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 |
| 2 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 0 |
| 3 | Type2B-ULChannelAccess  defined in [clause 4.2.1.2.3 in 37.213] | 2 |
| 4 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 0 |
| 5 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 |
| 6 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 |
| 7 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 |
| 8 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 1 |
| 9 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 2 |
| 10 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 3 |

< 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 >

- PUCCH resource indicator – 0 or 1 or 2 or 3 bits determined by higher layer parameter *numberOfBitsForPUCCH-ResourceIndicatorDCI-1-2*

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

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

- 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-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* if present for the secondary PUCCH group, and *pdsch-HARQ-ACK-enhType3List* is replaced by *pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup* if present 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* if present for the secondary PUCCH group.

- Cross priority multiplexing indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *dynaIndicationOfCrossPriMux* is configured.

- 0 bit otherwise.

- 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 >

- Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-1-2* is not configured; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].

- ChannelAccess-CPext – 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-2* or in Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 are configured by the higher layer parameter *ul-AccessConfigListDCI-1-2.*

- PUCCH Cell indicator – 0 or 1 bit.

- 1 bit if higher layer parameter *pucch-sSCellDynDCI-1-2* is configured.

- 0 bit otherwise.

If DCI formats 1\_2 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\_2 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_2 monitored in the multiple search spaces.

< Unchanged parts are omitted >

##### 7.3.1.3.3 Format 2\_2

DCI format 2\_2 is used for the transmission of TPC commands for PUCCH and PUSCH.

The following information is transmitted by means of the DCI format 2\_2 with CRC scrambled by TPC-PUSCH-RNTI or TPC-PUCCH-RNTI:

- block number 1, block number 2,…, block number *N*

The parameter *tpc-PUSCH,* *tpc-PUCCH*,or *tpc-IndexsSCell* provided by higher layers determines the index to the block number for an UL of a cell, with the following fields defined for each block:

- Closed loop indicator – 0 or 1 bit.

- For DCI format 2\_2 with TPC-PUSCH-RNTI, 0 bit if the UE is not configured with high layer parameter *twoPUSCH-PC-AdjustmentStates*, in which case UE assumes each block in the DCI format 2\_2 is of 2 bits; 1 bit otherwise, in which case UE assumes each block in the DCI format 2\_2 is of 3 bits;

- For DCI format 2\_2 with TPC-PUCCH-RNTI, 0 bit if the UE is not configured with high layer parameter *twoPUCCH-PC-AdjustmentStates*, in which case UE assumes each block in the DCI format 2\_2 is of 2 bits; 1 bit otherwise, in which case UE assumes each block in the DCI format 2\_2 is of 3 bits;

- TPC command –2 bits

The number of information bits in format 2\_2 shall be equal to or less than the payload size of format 1\_0 monitored in common search space in the same serving cell. If the number of information bits in format 2\_2 is less than the payload size of format 1\_0 monitored in common search space in the same serving cell, zeros shall be appended to format 2\_2 until the payload size equals that of format 1\_0 monitored in common search space in the same serving cell.

< Unchanged parts are omitted >