**3GPP TSG-RAN WG1 Meeting #114 *R1-23xxxxx***

**Toulouse, France, August 21-25, 2023**

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| *CR-Form-v12.2* |
| **Draft CHANGE REQUEST** |
|  |
|  | **38.212** | **CR** |  | **rev** | **-** | **Current version:** | **17.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Introduction of Rel-18 further NR Coverage enhancement |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_cov\_enh2-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 canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Introduction of Rel-18 further NR Coverage enhancement |
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| ***Summary of change:*** | Support of further NR Coverage enhancement. DCI size alignement between with transform precoding and without transform precoding for dynamic waveform indication.  |
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| ***Consequences if not approved:*** | Rel-18 further NR Coverage enhancement will be incomplete.  |
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| ***Clauses affected:*** | 7.3.1.1.2, 7.3.1.1.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.214 |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

- 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 if *nrofHARQ-Processes-v1700* in *ConfiguredGrantConfig* is not configured or 32 bits if *nrofHARQ-Processes-v1700* in *ConfiguredGrantConfig* is configured, 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:

- UL/SUL indicator – 0 bit for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell or UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell but only one carrier in the cell is configured for PUSCH transmission; otherwise, 1 bit as defined in Table 7.3.1.1.1-1.

- Bandwidth part indicator – 0, 1 or 2 bits as determined by the number of UL BWPs  configured by higher layers, excluding the initial UL bandwidth part. The bitwidth for this field is determined as bits, where

-  if , in which case the bandwidth part indicator is equivalent to the ascending order of the higher layer parameter *BWP-Id*;

- otherwise , in which case the bandwidth part indicator is defined in Table 7.3.1.1.2-1;

If a UE does not support active BWP change via DCI, the UE ignores this bit field.

- Frequency domain resource assignment – number of bits determined by the following, where  is the size of the active UL bandwidth part:

- If higher layer parameter *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is not configured

-  bits if only resource allocation type 0 is configured, where  is defined in Clause 6.1.2.2.1 of [6, TS 38.214],

- bits if only resource allocation type 1 is configured, or  bits if *resourceAllocation* is configured as '*dynamicSwitch'*.

- If *resourceAllocation* is configured as '*dynamicSwitch'*, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.

- For resource allocation type 0, the  LSBs provide the resource allocation as defined in Clause 6.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the  LSBs provide the resource allocation as follows:

- For PUSCH hopping with resource allocation type 1:

-  MSB bits are used to indicate the frequency offset according to Clause 6.3 of [6, TS 38.214], where  if the higher layer parameter *frequencyHoppingOffsetLists* contains two offset values and  if the higher layer parameter *frequencyHoppingOffsetLists* contains four offset values

-  bits provide the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- For non-PUSCH hopping with resource allocation type 1:

-  bits provide the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if *resourceAllocation* is configured as '*dynamicSwitch'* for the indicated bandwidth part, the UE assumes resource allocation type 0 for the indicated bandwidth part if the bitwidth of the "Frequency domain resource assignment" field of the active bandwidth part is smaller than the bitwidth of the "Frequency domain resource assignment" field of the indicated bandwidth part.

- If the higher layer parameter *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured

- 5 + Y bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 30 kHz. The 5 MSBs provide the interlace allocation and the Y LSBs provide the RB set allocation.

- 6 + Y bits provide the frequency domain resource allocation according to Clause 6.1.2.2.3 of [6, TS 38.214] if the subcarrier spacing for the active UL bandwidth part is 15 kHz. The 6 MSBs provide the interlace allocation and the Y LSBs provide the RB set allocation.

The value of Y is determined by where is the number of RB sets contained in the active UL BWP as defined in clause 7 of [6, TS38.214].

- Time domain resource assignment – 0, 1, 2, 3, 4, 5, or 6 bits

- If the higher layer parameter *pusch-TimeDomainAllocationListDCI-0-1* is not configured and if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is not configured and if the higher layer parameter *pusch-TimeDomainAllocationList* is configured, 0, 1, 2, 3, or 4 bits as defined in Clause 6.1.2.1 of [6, TS38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pusch-TimeDomainAllocationList*;

- If the higher layer parameter *pusch-TimeDomainAllocationListDCI-0-1* is configured or if the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH* is configured, 0, 1, 2, 3, 4, 5 or 6 bits as defined in Clause 6.1.2.1 of [6, TS38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pusch-TimeDomainAllocationListDCI-0-1* or *pusch-TimeDomainAllocationListForMultiPUSCH*;

- otherwise the bitwidth for this field is determined as bits, where *I* is the number of entries in the default table*.*

- Frequency hopping flag – 0 or 1 bit:

- 0 bit if only resource allocation type 0 is configured, or if the higher layer parameter *frequencyHopping* is not configured and the higher layer parameter *pusch-RepTypeIndicatorDCI-0-1* is not configured to *pusch-RepTypeB*, or if the higher layer parameter *frequencyHoppingDCI-0-1* is not configured and *pusch-RepTypeIndicatorDCI-0-1* is configured to *pusch-RepTypeB*, or if only resource allocation type 2 is configured;

- 1 bit according to Table 7.3.1.1.1-3 otherwise, only applicable to resource allocation type 1, as defined in Clause 6.3 of [6, TS 38.214].

- Modulation and coding scheme – 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214]

- New data indicator – 1 bit if the number of scheduled PUSCH indicated by the Time domain resource assignment field is 1; otherwise 2, 3, 4, 5, 6, 7 or 8 bits determined based on the maximum number of schedulable PUSCH among all entries in the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH*, where each bit corresponds to one scheduled PUSCH as defined in clause 6.1.4 in [6, TS 38.214].

- Redundancy version – – number of bits determined by the following:

- 2 bits as defined in Table 7.3.1.1.1-2 if the number of scheduled PUSCH indicated by the Time domain resource assignment field is 1;

- otherwise 2, 3, 4, 5, 6, 7 or 8 bits determined by the maximum number of schedulable PUSCHs among all entries in the higher layer parameter *pusch-TimeDomainAllocationListForMultiPUSCH*, where each bit corresponds to one scheduled PUSCH as defined in clause 6.1.4 in [6, TS 38.214] and redundancy version is determined according to Table 7.3.1.1.2-34.

- Transform precoder indicator – 0 or 1 bit

- 1 bit if the higher layer parameter *dynamicTransformPrecoderIndicationDCI-0-1* is configured to 'enabled ' and if the UE is configured to monitor DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI, where the bit value of 0 indicates that transform precoder is enabled and the bit value of 1 indicates that transform precoder is disabled. For a DCI format 0\_1 with CRC scrambled by CS-RNTI and the value indicated by new data indicator field is 1, or for a DCI format 0\_1 with CRC scrambled by SP-CSI-RNTI, the bit is reserved.

- 0 bit otherwise.

- HARQ process number – 5 bits if higher layer parameter *harq-ProcessNumberSizeDCI-0-1* is configured; otherwise 4 bits

- 1st downlink assignment index – 1, 2 or 4 bits:

- 1 bit for semi-static HARQ-ACK codebook for unicast and multicast if *pdsch-HARQ-ACK-Codebook = semiStatic* is configured for both unicast and multicast and the higher layer parameter *fdmed-ReceptionMulticast* is not configured; otherwise for semi-static HARQ-ACK codebook for unicast;

- 2 bits for dynamic HARQ-ACK codebook for unicast, or for enhanced dynamic HARQ-ACK codebook without *UL-TotalDAI-Included* configured;

- 4 bits for enhanced dynamic HARQ-ACK codebook and with *UL-TotalDAI-Included = true*.

 When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-1* is configured, if the bit width of the 1st downlink assignment index in DCI format 0\_1 for one HARQ-ACK codebook is not equal to that of the 1st downlink assignment index in DCI format 0\_1 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller 1st downlink assignment index until the bit width of the 1st downlink assignment index in DCI format 0\_1 for the two HARQ-ACK codebooks are the same.

- 2nd downlink assignment index – 0, 2 or 4 bits:

- 2 bits for dynamic HARQ-ACK codebook with two HARQ-ACK sub-codebooks for unicast, or for enhanced dynamic HARQ-ACK codebook with two HARQ-ACK sub-codebooks and without *UL-TotalDAI-Included* configured;

- 4 bits for enhanced dynamic HARQ-ACK codebook with two HARQ-ACK sub-codebooks and with *UL-TotalDAI-Included = true*;

- 0 bit otherwise.

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-1* is configured, if the bit width of the 2nd downlink assignment index in DCI format 0\_1 for one HARQ-ACK codebook is not equal to that of the 2nd downlink assignment index in DCI format 0\_1 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller 2nd downlink assignment index until the bit width of the 2nd downlink assignment index in DCI format 0\_1 for the two HARQ-ACK codebooks are the same.

- 3rd downlink assignment index – 0, 1 or 2 bits:

- 1 bit for semi-static HARQ-ACK codebook for multicast if the higher layer parameter *fdmed-ReceptionMulticast* is configured;

- 2 bits for the dynamic HARQ-ACK codebook for multicast;

- 0 bit otherwise.

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookListMulticast* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-1* is configured, if the bit width of the 3rd downlink assignment index in DCI format 0\_1 for one HARQ-ACK codebook is not equal to that of the 3rd downlink assignment index in DCI format 0\_1 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller 3rd downlink assignment index until the bit width of the 3rd downlink assignment index in DCI format 0\_1 for the two HARQ-ACK codebooks are the same.

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

- Second TPC command for scheduled PUSCH – 2 bits as defined in Clause 7.1.1 of [5, TS38.213] if higher layer parameter *SecondTPCFieldDCI-0-1* is configured; 0 bit otherwise.

- SRS resource set indicator – 0 or 2 bits

- 2 bits according to Table 7.3.1.1.2-36 if

- *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with the *usage* of value '*nonCodeBook*', or

- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with *usage* of value '*codebook*';

- 0 bit otherwise.

- SRS resource indicator – or  bits, where  is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present; otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList* and associated with the higher layer parameter *usage* of value '*codeBook*' or '*nonCodeBook*',

-  bits according to Tables 7.3.1.1.2-28/29/30/31 if the higher layer parameter *txConfig = nonCodebook*, where  is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present, otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList* and associated with the higher layer parameter *usage* of value '*nonCodeBook*', and

- if UE supports operation with *maxMIMO-Layers* and the higher layer parameter *maxMIMO-Layers* of *PUSCH-ServingCellConfig* of the serving cell is configured, *Lmax* is given by that parameter

- otherwise, *Lmax* is given by the maximum number of layers for PUSCH supported by the UE for the serving cell for non-codebook based operation.

-  bits according to Tables 7.3.1.1.2-32, 7.3.1.1.2-32A and 7.3.1.1.2-32B if the higher layer parameter *txConfig = codebook*, where  is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present, otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList* and associated with the higher layer parameter *usage* of value '*codeBook*'.

- Second SRS resource indicator – 0, or bits,

- bits according to Tables 7.3.1.1.2-28/29A/30A/31A with the same number of layers indicated by SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set, and

- if UE supports operation with *maxMIMO-Layers* and the higher layer parameter *maxMIMO-Layers* of *PUSCH-ServingCellConfig* of the serving cell is configured, *Lmax* is given by that parameter

- otherwise, *Lmax* is given by the maximum number of layers for PUSCH supported by the UE for the serving cell for non-codebook based operation.

- bits according to Tables 7.3.1.1.2-32, 7.3.1.1.2-32A and 7.3.1.1.2-32B if the higher layer parameter *txConfig = codebook* and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set.

- 0 bit otherwise.

- Precoding information and number of layers – number of bits determined by the following:

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 4 or 5 bits according to Table 7.3.1.1.2-2A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1, maxRank=2,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 4 or 6 bits according to Table 7.3.1.1.2-2B for 4 antenna ports, if *txConfig = codebook, ul-FullPowerTransmission = fullpowerMode1,* *maxRank=3 or 4,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

- 2 or 4 bits according to Table7.3.1.1.2-4 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-4A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, transform precoder is disabled, *maxRank=2*, and *codebookSubset=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-5A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission* is configured to *fullpowerMode2*, maxRank is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in the SRS resource set indicated by SRS resource set indicator field if present, otherwise in an SRS resource set with usage set to 'codebook', and an SRS resource with 2 antenna ports is indicated via SRI in the same SRS resource set, then *Table* 7.3.1.1.2-4 is used.

For the higher layer parameter *txConfig = codebook*, if different SRS resources with different number of antenna ports are configured, the bitwidth is determined according to the maximum number of ports in an SRS resource among the configured SRS resources in all SRS resource set(s) with usage set to 'codebook'. If the number of ports for a configured SRS resource in the set is less than the maximum number of ports in an SRS resource among the configured SRS resources, a number of most significant bits with value set to '0' are inserted to the field.

For the higher layer parameter *txConfig = codebook*, when the Transform precoder indicator field is present, if the bit width of the Precoding information and number of layers field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Precoding information and number of layers field for the case with smaller bit width until the bit width of the Precoding information and number of layers field for the two cases are the same.

- Second Precoding information – number of bits determined by the following:

- 0 bits if SRS resource set indicator field is not present;

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 3, 4, or 5 bits according to Table 7.3.1.1.2-2C with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-2D with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1, maxRank=2,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-2E with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook, ul-FullPowerTransmission = fullpowerMode1,* *maxRank=3 or 4,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

- 1 or 3 bits according to Table7.3.1.1.2-4B with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-4C with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, transform precoder is disabled, *maxRank=2*, and *codebookSubset=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-5A with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission* is configured to *fullpowerMode2*, maxRank is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in the SRS resource set indicated by SRS resource set indicator field, and an SRS resource with 2 antenna ports is indicated via Second SRS resource indicator field in the same SRS resource set, then Table 7.3.1.1.2-4B is used.

For the higher layer parameter *txConfig = codebook*, if different SRS resources with different number of antenna ports are configured, the bitwidth is determined according to the maximum number of ports in an SRS resource among the configured SRS resources in the second SRS resource set with usage set to 'codebook' as defined in Table 7.3.1.1.2-36. If the number of ports for a configured SRS resource in the set is less than the maximum number of ports in an SRS resource among the configured SRS resources, a number of most significant bits with value set to '0' are inserted to the field.

For the higher layer parameter *txConfig = codebook*, when the Transform precoder indicator field is present, if the bit width of the Second Precoding information field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Second Precoding information field for the case with smaller bit width until the bit width of the Second Precoding information field for the two cases are the same.

- Antenna ports – number of bits determined by the following

- 2 bits as defined by Tables 7.3.1.1.2-6, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=1, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;

- 2 bits as defined by Tables 7.3.1.1.2-6A, if transform precoder is enabled and *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=1, where nSCID is the scrambling identity for antenna ports defined in [Clause 6.4.1.1.1.2, TS38.211];

- 4 bits as defined by Tables 7.3.1.1.2-7, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=2, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;

- 4 bits as defined by Tables 7.3.1.1.2-7A, if transform precoder is enabled and *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=2, where nSCID is the scrambling identity for antenna ports defined in [Clause 6.4.1.1.1.2, TS38.211];

- 3 bits as defined by Tables 7.3.1.1.2-8/9/10/11, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 4 bits as defined by Tables 7.3.1.1.2-12/13/14/15, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 4 bits as defined by Tables 7.3.1.1.2-16/17/18/19, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 5 bits as defined by Tables 7.3.1.1.2-20/21/22/23, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*.

where the number of CDM groups without data of values 1, 2, and 3 in Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively.

If a UE is configured with both *dmrs-UplinkForPUSCH-MappingTypeA* and *dmrs-UplinkForPUSCH-MappingTypeB*, the bitwidth of this field equals , where  is the "Antenna ports" bitwidth derived according to *dmrs-UplinkForPUSCH-MappingTypeA* and  is the "Antenna ports" bitwidthderived according to *dmrs-UplinkForPUSCH-MappingTypeB*. A number of  zeros are padded in the MSB of this field, if the mapping type of the PUSCH corresponds to the smaller value of  and .

When the Transform precoder indicator field is present, if the bit width of the Antenna ports field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Antenna ports field for the case with smaller bit width until the bit width of the Antenna ports field for the two cases are the same.

- SRS request – 2 bits as defined by Table 7.3.1.1.2-24 for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell; 3 bits for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell where the first bit is the non-SUL/SUL indicator as defined in Table 7.3.1.1.1-1 and the second and third bits are defined by Table 7.3.1.1.2-24. This bit field may also indicate the associated CSI-RS according to Clause 6.1.1.2 of [6, TS 38.214].

- SRS offset indicator – 0, 1 or 2 bits.

- 0 bit if higher layer parameter *AvailableSlotOffset* is not configured for any aperiodic SRS resource set in the scheduled cell, or if higher layer parameter *AvailableSlotOffset* is configured for at least one aperiodic SRS resource set in the scheduled cell and the maximum number of entries of *availableSlotOffsetList* configured for all aperiodic SRS resource set(s) is 1;

- otherwise, bits are used to indicate available slot offset according to Table 7.3.1.1.2-37 and Clause 6.2.1 of [6, TS 38.214], where K is the maximum number of entries of *availableSlotOffsetList* configured for all aperiodic SRS resource set(s) in the scheduled cell;

- CSI request – 0, 1, 2, 3, 4, 5, or 6 bits determined by higher layer parameter *reportTriggerSize*.

- CBG transmission information (CBGTI) – 0 bit if higher layer parameter *codeBlockGroupTransmission* for PUSCH is not configured or if the number of scheduled PUSCH indicated by the Time domain resource assignment field is larger than 1; otherwise, 2, 4, 6, or 8 bits determined by higher layer parameter *maxCodeBlockGroupsPerTransportBlock* for PUSCH.

- PTRS-DMRS association – number of bits determined as follows

- 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRank=1*;

- 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRank>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" and "11" and *maxRank=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and the "PTRS-DMRS association" field is present for the indicated bandwidth part but not present for the active bandwidth part, the UE assumes the "PTRS-DMRS association" field is not present for the indicated bandwidth part.

When the Transform precoder indicator field is present, if the bit width of PTRS-DMRS association field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the PTRS-DMRS association field for the case with smaller bit width until the bit width of the PTRS-DMRS association field for the two cases are the same.

- Second PTRS-DMRS association – 2 bits if PTRS-DMRS association field and SRS resource set indicator field are present and *maxRank>2*; 0 bit otherwise. Table 7.3.1.1.2-25 and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second precoding information field when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field.

- beta\_offset indicator – 0 if the higher layer parameter *betaOffsets = semiStatic*; otherwise 2 bits as defined by Table 9.3-3 in [5, TS 38.213].

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* or by *pdsch-HARQ-ACK-CodebookListMulticast* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-1* is configured, if the bit width of the beta\_offset indicator in DCI format 0\_1 for one HARQ-ACK codebook is not equal to that of the beta\_offset indicator in DCI format 0\_1 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller beta\_offset indicator until the bit width of the beta\_offset indicator in DCI format 0\_1 for the two HARQ-ACK codebooks are the same.

- DMRS sequence initialization – 0 bit if transform precoder is enabled; 1 bit if transform precoder is disabled or if the Transform precoder indicator field is present.

- UL-SCH indicator – 0 or 1 bit as follows

- 0 bit if the number of scheduled PUSCH indicated by the Time domain resource assignment field is larger than 1;

- 1 bit otherwise. 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. If a UE does not support triggering SRS only in DCI, except for DCI format 0\_1 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_1 with UL-SCH indicator of "0" and CSI request of all zero(s). If a UE supports triggering SRS only in DCI, except for DCI format 0\_1 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_1 with UL-SCH indicator of "0", CSI request of all zero(s) and SRS 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-0-1* 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 in frequency range 1, or for operation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

- 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\_1;

- 1 or 2 bits as determined by higher layer parameter *olpc-ParameterSetDCI-0-1* if SRS resource indicator is not present in the DCI format 0\_1.

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

- Invalid symbol pattern indicator – 0 bit if higher layer parameter *invalidSymbolPatternIndicatorDCI-0-1* is not configured; otherwise 1 bit as defined in Clause 6.1.2.1 in [6, TS 38.214].

- Minimum applicable scheduling offset indicator – 0 or 1 bit

- 0 bit if higher layer parameter *minimumSchedulingOffsetK2* is not configured;

- 1 bit if higher layer parameter *minimumSchedulingOffsetK2* is configured. The 1 bit indication is used to determine the minimum applicable K2 for the active UL BWP and the minimum applicable K0 value for the active DL BWP, if configured respectively, according to Table 7.3.1.1.2-33. If the minimum applicable K0 is indicated, the minimum applicable value of the aperiodic CSI-RS triggering offset for an active DL BWP shall be the same as the minimum applicable K0 value.

- 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 the number of different *DormancyGroupID(s)* provided by 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 in ascending order of *DormancyGroupID*. 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.

- Sidelink assignment index – 0, 1 or 2 bits:

- 1 bit if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *semi-static* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;

- 2 bits if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *dynamic* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;

- 0 bit otherwise.

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *pdcch-SkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *pdcch-SkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *pdcch-SkippingDurationList*.

- 1 or 2 bits, if *pdcch-SkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 1 bit if the UE is configured by *searchSpaceGroupIdList-r17* with search space set(s) with group index 0 and search space set(s) with group index 1, and if the UE is not configured by *searchSpaceGroupIdList-r17* with any search space set with group index 2;

- 2 bits if the UE is configured by *searchSpaceGroupIdList-r17* with search space set(s) with group index 0, search space set(s) with group index 1 and search space set(s) with group index 2;

- 2 bits, if *pdcch-SkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

A UE does not expect that the bit width of a field in DCI format 0\_1 with CRC scrambled by CS-RNTI is larger than corresponding bit width of same field in DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell. If the bit width of a field in the DCI format 0\_1 with CRC scrambled by CS-RNTI is not equal to that of the corresponding field in the DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell, a number of most significant bits with value set to '0' are inserted to the field in DCI format 0\_1 with CRC scrambled by CS-RNTI until the bit width equals that of the corresponding field in the DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell.

If the number of information bits in DCI format 0\_1 scheduling a single PUSCH prior to padding is not equal to the number of information bits in DCI format 0\_1 scheduling multiple PUSCHs for the same serving cell, zeros shall be appended to the DCI format 0\_1 with smaller size until the payload size is the same for scheduling a single PUSCH and multiple PUSCHs.

For a UE configured with scheduling on the primary cell from an SCell, if prior to padding the number of information bits in DCI format 0\_1 carried by PDCCH on the primary cell is not equal to the number of information bits in DCI format 0\_1 carried by PDCCH on the SCell for scheduling on the primary cell, zeros shall be appended to the DCI format 0\_1 with smaller size until the payload size is the same.

- If application of step 4C in clause 7.3.1.0 results in additional zero padding for DCI format 0\_1 for scheduling on the primary cell, corresponding zeros shall be appended to both DCI format 0\_1 monitored on the primary cell and DCI format 0\_1 monitored on the SCell for scheduling on the primary cell.

- If the SCell is deactivated and *firstActiveDownlinkBWP-Id* is not set to dormant BWP, the UE determines the number of information bits in DCI format 0\_1 carried by PDCCH on the primary cell based on a DL BWP provided by *firstActiveDownlinkBWP-Id* for the SCell. If the active DL BWP of the SCell is a dormant DL BWP, or if the SCell is deactivated and *firstActiveDownlinkBWP-Id* is set to dormant BWP, the UE determines the number of information bits in DCI format 0\_1 carried by PDCCH on the primary cell based on a DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided; otherwise, based on a DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.

**Table 7.3.1.1.2-1: Bandwidth part indicator**

|  |  |
| --- | --- |
| Value of BWP indicator field | Bandwidth part |
| 2 bits |
| 00 | Configured BWP with BWP-Id = 1 |
| 01 | Configured BWP with BWP-Id = 2 |
| 10 | Configured BWP with BWP-Id = 3 |
| 11 | Configured BWP with BWP-Id = 4 |

< Unchanged parts are omitted >

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]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

- UL/SUL indicator – 0 bit for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell or UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell but only one carrier in the cell is configured for PUSCH transmission; otherwise, 1 bit as defined in Table 7.3.1.1.1-1.

- Bandwidth part indicator – 0, 1 or 2 bits as determined by the number of UL BWPs configured by higher layers, excluding the initial UL bandwidth part. The bitwidth for this field is determined as bits, where

- if , in which case the bandwidth part indicator is equivalent to the ascending order of the higher layer parameter *BWP-Id*;

- otherwise , in which case the bandwidth part indicator is defined in Table 7.3.1.1.2-1;

If a UE does not support active BWP change via DCI, the UE ignores this bit field.

- Frequency domain resource assignment – number of bits determined by the following:

- bits if only resource allocation type 0 is configured, where is defined in Clause 6.1.2.2.1 of [6, TS 38.214]

- bits if only resource allocation type 1 is configured, or bits if *resourceAllocationDCI-0-2-r16* is configured as '*dynamicSwitch'*, where is the size of the active UL bandwidth part, is defined as in clause 4.4.4.4 of [4, TS 38.211] and is given by higher layer parameter *resourceAllocationType1GranularityDCI-0-2.* If the higher layer parameter *resourceAllocationType1GranularityDCI-0-2* is not configured, is equal to 1.

- If *resourceAllocationDCI-0-2-r16* is configured as '*dynamicSwitch'*, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.

- For resource allocation type 0, the LSBs provide the resource allocation as defined in Clause 6.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the LSBs provide the resource allocation as follows:

- For PUSCH hopping with resource allocation type 1:

- MSB bits are used to indicate the frequency offset according to Clause 6.3 of [6, TS 38.214], where if the higher layer parameter *frequencyHoppingOffsetListsDCI-0-2* contains two offset values and if the higher layer parameter *frequencyHoppingOffsetListsDCI-0-2* contains four offset values

- bits provide the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

- For non-PUSCH hopping with resource allocation type 1:

- bits provide the frequency domain resource allocation according to Clause 6.1.2.2.2 of [6, TS 38.214]

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if *resourceAllocationDCI-0-2-r16* is configured as '*dynamicSwitch'* for the indicated bandwidth part, the UE assumes resource allocation type 0 for the indicated bandwidth part if the bitwidth of the "Frequency domain resource assignment" field of the active bandwidth part is smaller than the bitwidth of the "Frequency domain resource assignment" field of the indicated bandwidth part.

- Time domain resource assignment – 0, 1, 2, 3, 4, 5 or 6 bits as defined in Clause 6.1.2.1 of [6, TS38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pusch-TimeDomainAllocationListDCI-0-2* if the higher layer parameter is configured, or *I* is the number of entries in the higher layer parameter *PUSCH-TimeDomainResourceAllocationList* if the higher layer parameter *PUSCH-TimeDomainResourceAllocationList* is configured and the higher layer parameter *pusch-TimeDomainAllocationListDCI-0-2* is not configured; otherwise *I* is the number of entries in the default table*.*

- Frequency hopping flag – 0 or 1 bit:

- 0 bit if the higher layer parameter *frequencyHoppingDCI-0-2* is not configured;

- 1 bit according to Table 7.3.1.1.1-3 otherwise, only applicable to resource allocation type 1, as defined in Clause 6.3 of [6, TS 38.214].

- Modulation and coding scheme –5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214]

- New data indicator – 1 bit

- Redundancy version – 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-0-2*

- If 0 bit is configured, *rvid* to be applied is 0;

- 1 bit according to Table 7.3.1.2.3-1;

- 2 bits according to Table 7.3.1.1.1-2.

- Transform precoder indicator – 0 or 1 bit

- 1 bit if the higher layer parameter *dynamicTransformPrecoderIndicationDCI-0-2* is configured to 'enabled ' and if the UE is configured to monitor DCI format 0\_2 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI, where the bit value of 0 indicates that transform precoder is enabled and the bit value of 1 indicates that transform precoder is disabled. For a DCI format 0\_2 with CRC scrambled by CS-RNTI and the value indicated by new data indicator field is 1, or for a DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, the bit is reserved.

- 0 bit otherwise.

- HARQ process number – number of bits determined by the following:

- 5 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-0-2-v1700* if configured;

- otherwise 0, 1, 2, 3 or 4 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-0-2*

- Downlink assignment index – 0, 1, 2 or 4 bits

- 0 bit if the higher layer parameter *downlinkAssignmentIndexDCI-0-2* is not configured;

- 1, 2, 3, 4, 5 or 6 bits otherwise,

- 1st downlink assignment index – 1 or 2 bits:

- 1 bit for semi-static HARQ-ACK codebook for unicast and multicast if *pdsch-HARQ-ACK-Codebook = semiStatic* is configured for both unicast and multicast and the higher layer parameter *fdmed-ReceptionMulticast* is not configured; otherwise for semi-static HARQ-ACK codebook for unicast;

- 2 bits for dynamic HARQ-ACK codebook for unicast.

- 2nd downlink assignment index – 0 or 2 bits

- 2 bits for dynamic HARQ-ACK codebook with two HARQ-ACK sub-codebooks for unicast;

- 0 bit otherwise.

- 3rd downlink assignment index – 0, 1 or 2 bits

- 1 bit for semi-static HARQ-ACK codebook for multicast if the higher layer parameter *fdmed-ReceptionMulticast* is configured;

- 2 bits for the dynamic HARQ-ACK codebook for multicast;

- 0 bit otherwise.

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-2* is configured, if the bit width of the 1st or 2 nd Downlink assignment index in DCI format 0\_2 for one HARQ-ACK codebook is not equal to that of the 1st or 2 nd Downlink assignment index in DCI format 0\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller 1st or 2 nd Downlink assignment index until the bit width of the 1st or 2 nd Downlink assignment index in DCI format 0\_2 for the two HARQ-ACK codebooks are the same.

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookListMulticast* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-2* is configured, if the bit width of the 3rd downlink assignment index in DCI format 0\_2 for one HARQ-ACK codebook is not equal to that of the 3rd downlink assignment index in DCI format 0\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller 3rd downlink assignment index until the bit width of the 3rd downlink assignment index in DCI format 0\_2 for the two HARQ-ACK codebooks are the same.

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

- Second TPC command for scheduled PUSCH – 2 bits as defined in Clause 7.1.1 of [5, TS38.213] if higher layer parameter *SecondTPCFieldDCI-0-2* is configured; 0 bit otherwise.

- SRS resource set indicator – 0 or 2 bits

- 2 bits according to Table 7.3.1.1.2-36 if

- *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with the *usage* of value '*nonCodeBook*', or

- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*';

- 0 bit otherwise.

- SRS resource indicator – or bits, where is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present; otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModListDCI-0-2* and associated with the higher layer parameter *usage* of value '*codeBook*' or '*nonCodeBook*', where the SRS resource set is composed of the first SRS resources together with other configurations in the SRS resource set, or in the SRS resource set with lower srs-ResourceSetId of two SRS resources sets, configured by higher layer parameter *srs-ResourceSetToAddModList*, if any, and associated with the higher layer parameter *usage* of value '*codeBook*' or '*nonCodeBook*', respectively, except for the higher layer parameters *'srs-ResourceSetId' and 'srs-ResourceIdList'*

- bits according to Tables 7.3.1.1.2-28/29/30/31 if the higher layer parameter *txConfig = nonCodebook*, where is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present, otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModListDCI-0-2* and associated with the higher layer parameter *usage* of value '*nonCodeBook*', where the SRS resource set is composed of the first SRS resources together with other configurations in the SRS resource set, or in the SRS resource set with lower srs-ResourceSetId of two SRS resources sets, configured by higher layer parameter *srs-ResourceSetToAddModList*, if any, and associated with the higher layer parameter *usage* of value '*nonCodeBook*', except for the higher layer parameters *'srs-ResourceSetId' and 'srs-ResourceIdList',* and

- if UE supports operation with *maxMIMO-LayersDCI-0-2* and the higher layer parameter *maxMIMO-LayersDCI-0-2* of *PUSCH-ServingCellConfig* of the serving cell is configured, *Lmax* is given by that parameter

- otherwise, *Lmax* is given by the maximum number of layers for PUSCH supported by the UE for the serving cell for non-codebook based operation.

- bits according to Tables 7.3.1.1.2-32 if the higher layer parameter *txConfig = codebook*, where is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present, otherwise is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModListDCI-0-2* and associated with the higher layer parameter *usage* of value '*codeBook*', where the SRS resource set is composed of the first SRS resources together with other configurations in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList*, if any, and associated with the higher layer parameter *usage* of value '*codeBook*', except for the higher layer parameters *'srs-ResourceSetId' and 'srs-ResourceIdList'*.

- Second SRS resource indicator – 0, or bits,

- bits according to Tables 7.3.1.1.2-28/29A/30A/31A with the same number of layers indicated by SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set*,* and

- if UE supports operation with *maxMIMO-LayersDCI-0-2* and the higher layer parameter *maxMIMO-LayersDCI-0-2* of *PUSCH-ServingCellConfig* of the serving cell is configured, *Lmax* is given by that parameter

- otherwise, *Lmax* is given by the maximum number of layers for PUSCH supported by the UE for the serving cell for non-codebook based operation.

- bits according to Tables 7.3.1.1.2-32 if the higher layer parameter *txConfig = codebook* and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set.

- 0 bit otherwise.

- Precoding information and number of layers – number of bits determined by the following:

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRankDCI-0-2*, and *codebookSubsetDCI-0-2*;

- 4 or 5 bits according to Table 7.3.1.1.2-2A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1,* the values of higher layer parameters *maxRankDCI-0-2=2,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 4 or 6 bits according to Table 7.3.1.1.2-2B for 4 antenna ports, if *txConfig = codebook, ul-FullPowerTransmission =fullpowerMode1,* the values of higher layer parameters *maxRankDCI-0-2=3 or 4,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRankDCI-0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 2 or 4 bits according to Table7.3.1.1.2-4 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 2 bits according to Table 7.3.1.1.2-4A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, transform precoder is disabled, the *maxRankDCI-0-2=2*, and *codebookSubsetDCI-0-2=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 2 bits according to Table 7.3.1.1.2-5A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRankDCI-0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*.

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission* is configured to *fullpowerMode2*, the values of higher layer parameters *maxRankDCI-0-2* is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in the SRS resource set indicated by SRS resource set indicator field if present, otherwise in an SRS resource set with usage set to 'codebook', and an SRS resource with 2 antenna ports is indicated via SRI in the same SRS resource set, then Table 7.3.1.1.2-4 is used.

For the higher layer parameter *txConfig = codebook*, if different SRS resources with different number of antenna ports are configured, the bitwidth is determined according to the maximum number of ports in an SRS resource among the configured SRS resources in all SRS resource set(s) with usage set to 'codebook'. If the number of ports for a configured SRS resource in the set is less than the maximum number of ports in an SRS resource among the configured SRS resources, a number of most significant bits with value set to '0' are inserted to the field.

For the higher layer parameter *txConfig = codebook*, when the Transform precoder indicator field is present, if the bit width of the Precoding information and number of layers field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Precoding information and number of layers field for the case with smaller bit width until the bit width of the Precoding information and number of layers field for the two cases are the same.

- Second Precoding information – number of bits determined by the following:

- 0 bits if SRS resource set indicator field is not present;

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 3, 4, or 5 bits according to Table 7.3.1.1.2-2C with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRankDCI-0-2*, and *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-2D with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1,* the values of higher layer parameters *maxRankDCI-0-2=2,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-2E with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook, ul-FullPowerTransmission =fullpowerMode1,* the values of higher layer parameters *maxRankDCI-0-2=3 or 4,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRankDCI-0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 1 or 3 bits according to Table7.3.1.1.2-4B with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 2 bits according to Table 7.3.1.1.2-4C with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, transform precoder is disabled, the *maxRankDCI-0-2=2*, and *codebookSubsetDCI-0-2=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRankDCI-0-2* and *codebookSubsetDCI-0-2*;

- 2 bits according to Table 7.3.1.1.2-5A with the same number of layers indicated by Precoding information and number of layers field for 2 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRankDCI-0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*.

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission* is configured to *fullpowerMode2*, the values of higher layer parameters *maxRankDCI-0-2* is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in the SRS resource set indicated by SRS resource set indicator field, and an SRS resource with 2 antenna ports is indicated via Second SRS resource indicator field in the same SRS resource set, then Table 7.3.1.1.2-4B is used.

For the higher layer parameter *txConfig = codebook*, if different SRS resources with different number of antenna ports are configured, the bitwidth is determined according to the maximum number of ports in an SRS resource among the configured SRS resources in the second SRS resource set with usage set to 'codebook' as defined in Table 7.3.1.1.2-36. If the number of ports for a configured SRS resource in the set is less than the maximum number of ports in an SRS resource among the configured SRS resources, a number of most significant bits with value set to '0' are inserted to the field.

For the higher layer parameter *txConfig = codebook*, when the Transform precoder indicator field is present, if the bit width of the Second Precoding information field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Second Precoding information field for the case with smaller bit width until the bit width of the Second Precoding information field for the two cases are the same.

- Antenna ports – number of bits determined by the following:

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

- 2, 3, 4, or 5 bits otherwise,

- 2 bits as defined by Tables 7.3.1.1.2-6, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=1, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;

- 2 bits as defined by 7.3.1.1.2-6A, if transform precoder is enabled, and *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=1, where nSCID is the scrambling identity for antenna ports defined in Clause 6.4.1.1.1.2, in [4, TS38.211];

- 4 bits as defined by Tables 7.3.1.1.2-7, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=2, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;

- 4 bits as defined by Tables 7.3.1.1.2-7A, if transform precoder is enabled, and *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=2, where *nSCID* is the scrambling identity for antenna ports defined in Clause 6.4.1.1.1.2, in [4, TS38.211];

- 3 bits as defined by Tables 7.3.1.1.2-8/9/10/11, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 4 bits as defined by Tables 7.3.1.1.2-12/13/14/15, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 4 bits as defined by Tables 7.3.1.1.2-16/17/18/19, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;

- 5 bits as defined by Tables 7.3.1.1.2-20/21/22/23, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*.

where the number of CDM groups without data of values 1, 2, and 3 in Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively.

If a UE is configured with both *dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2* and *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2* and is configured with *antennaPortsFieldPresenceDCI-0-2*, the bitwidth of this field equals , where is the "Antenna ports" bitwidth derived according to *dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2* and is the "Antenna ports" bitwidthderived according to *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2*. A number of zeros are padded in the MSB of this field, if the mapping type of the PUSCH corresponds to the smaller value of and .

If a UE is not configured with higher layer parameter *antennaPortsFieldPresenceDCI-0-2,* antenna port(s) are defined assuming bit field index value 0 in Tables 7.3.1.1.2-6 to 7.3.1.1.2-23.

When the Transform precoder indicator field is present, if the bit width of the Antenna ports field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the Antenna ports field for the case with smaller bit width until the bit width of the Antenna ports field for the two cases are the same.

- SRS request – 0, 1, 2 or 3 bits

- 0 bit if the higher layer parameter *srs-RequestDCI-0-2* is not configured;

- 1 bit as defined by Table 7.3.1.1.3-1 if higher layer parameter *srs-RequestDCI-0-2 = 1* and for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell;

- 2 bits if higher layer parameter *srs-RequestDCI-0-2 = 1* and for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell, where the first bit is the non-SUL/SUL indicator as defined in Table 7.3.1.1.1-1 and the second bit is defined by Table 7.3.1.1.3-1;

- 2 bits as defined by Table 7.3.1.1.2-24 if higher layer parameter *srs-RequestDCI-0-2 = 2* and for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell;

- 3 bits if higher layer parameter *srs-RequestDCI-0-2 = 2* and for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell, where the first bit is the non-SUL/SUL indicator as defined in Table 7.3.1.1.1-1 and the second and third bits are defined by Table 7.3.1.1.2-24;

- SRS offset indicator – 0, 1 or 2 bits.

- 0 bit if higher layer parameter *AvailableSlotOffset* is not configured for any aperiodic SRS resource set in the scheduled cell, or if higher layer parameter *AvailableSlotOffset* is configured for at least one aperiodic SRS resource set in the scheduled cell and the maximum number of entries of *availableSlotOffsetList* configured for all aperiodic SRS resource set(s) is 1;

- otherwise, bits are used to indicate available slot offset according to Table 7.3.1.1.2-37 and Clause 6.2.1 of [6, TS 38.214], where K is the maximum number of entries of *availableSlotOffsetList* configured for all aperiodic SRS resource set(s) in the scheduled cell;

- CSI request – 0, 1, 2, 3, 4, 5, or 6 bits determined by higher layer parameter *reportTriggerSizeDCI-0-2*.

- PTRS-DMRS association – number of bits determined as follows

- 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1*;

- 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRankDCI-0-2>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26 field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" and "11" and *maxRankDCI-0-2=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and the "PTRS-DMRS association" field is present for the indicated bandwidth part but not present for the active bandwidth part, the UE assumes the "PTRS-DMRS association" field is not present for the indicated bandwidth part.

When the Transform precoder indicator field is present, if the bit width of PTRS-DMRS association field for the case with transform precoder enabled is not equal to that for the case with transform precoder disabled, a number of most significant bits with value set to '0' are inserted to the PTRS-DMRS association field for the case with smaller bit width until the bit width of the PTRS-DMRS association field for the two cases are the same.

- Second PTRS-DMRS association – 2 bits if PTRS-DMRS association field and SRS resource set indicator field are present and *maxRankDCI-0-2>2*; 0 bit otherwise. Table 7.3.1.1.2-25 and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second precoding information field when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field.

- beta\_offset indicator – 0 bit if the higher layer parameter *betaOffsetsDCI-0-2 = semiStaticDCI-0-2*; otherwise 1 bit if 2 offset indexes are configured by higher layer parameter *dynamicDCI-0-2* as defined by Table 9.3-3A in [5, TS 38.213], and 2 bits if 4 offset indexes are configured by higher layer parameter *dynamicDCI-0-2* as defined by Table 9.3-3 in [5, TS 38.213].

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* or by *pdsch-HARQ-ACK-CodebookListMulticast* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-2* is configured, if the bit width of the beta\_offset indicator in DCI format 0\_2 for one HARQ-ACK codebook is not equal to that of the beta\_offset indicator in DCI format 0\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller beta\_offset indicator until the bit width of the beta\_offset indicator in DCI format 0\_2 for the two HARQ-ACK codebooks are the same.

- 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, or if the Transform precoder indicator field is present.

- 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. If a UE does not support triggering SRS only in DCI, except for DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_2 with UL-SCH indicator of "0" and CSI request of all zero(s). If a UE supports triggering SRS only in DCI, except for DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to recerive a DCI format 0\_2 with UL-SCH indicator of "0", CSI request of all zero(s) and SRS 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 in frequency range 1, or the number of entries in the high layer parameter *ul-AccessConfigListDCI-0-1* foroperation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; 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* in frequency range 1*.* One or more entries from Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1* in frequency range 2-2*.*

- 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;

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

- Invalid symbol pattern indicator – 0 bit if higher layer parameter *invalidSymbolPatternIndicatorDCI-0-2* is not configured; otherwise 1 bit as defined in Clause 6.1.2.1 in [6, TS 38.214].

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *pdcch-SkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *pdcch-SkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *pdcch-SkippingDurationList*.

- 1 or 2 bits, if *pdcch-SkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 1 bit if the UE is configured by *searchSpaceGroupIdList-r17* with search space set(s) with group index 0 and search space set(s) with group index 1, and if the UE is not configured by *searchSpaceGroupIdList-r17* with any search space set with group index 2;

- 2 bits if the UE is configured by *searchSpaceGroupIdList-r17* with search space set(s) with group index 0, search space set(s) with group index 1 and search space set(s) with group index 2;

- 2 bits, if *pdcch-SkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

A UE does not expect that the bit width of a field in DCI format 0\_2 with CRC scrambled by CS-RNTI is larger than corresponding bit width of same field in DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell. If the bit width of a field in the DCI format 0\_2 with CRC scrambled by CS-RNTI is not equal to that of the corresponding field in the DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell, a number of most significant bits with value set to '0' are inserted to the field in DCI format 0\_2 with CRC scrambled by CS-RNTI until the bit width equals that of the corresponding field in the DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell.

For a UE configured with scheduling on the primary cell from an SCell, if prior to padding the number of information bits in DCI format 0\_2 carried by PDCCH on the primary cell is not equal to the number of information bits in DCI format 0\_2 carried by PDCCH on the SCell for scheduling on the primary cell, zeros shall be appended to the DCI format 0\_2 with smaller size until the payload size is the same.

- If application of step 4B in clause 7.3.1.0 results in additional zero padding for DCI format 0\_2 for scheduling on the primary cell, corresponding zeros shall be appended to both DCI format 0\_2 monitored on the primary cell and DCI format 0\_2 monitored on the SCell for scheduling on the primary cell.

- If the SCell is deactivated and *firstActiveDownlinkBWP-Id* is not set to dormant BWP, the UE determines the number of information bits in DCI format 0\_2 carried by PDCCH on the primary cell based on a DL BWP provided by *firstActiveDownlinkBWP-Id* for the SCell. If the active DL BWP of the SCell is a dormant DL BWP, or if the SCell is deactivated and *firstActiveDownlinkBWP-Id* is set to dormant BWP, the UE determines the number of information bits in DCI format 0\_2 carried by PDCCH on the primary cell based on a DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided; otherwise, based on a DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.

**Table 7.3.1.1.3-1: 1 bit SRS request in DCI format 0\_2 and DCI format 1\_2**

|  |  |
| --- | --- |
| **Value of SRS request field** | **Triggered aperiodic SRS resource set(s) for DCI format 0\_2 and 1\_2** |
| 0 | No aperiodic SRS resource set triggered |
| 1 | SRS resource set(s) configured with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 1 or an entry in *aperiodicSRS-ResourceTriggerList* set to 1 |