**3GPP TSG-RAN WG1 Meeting 106bis-e *R1-21xxxxx***

**e-Meeting, October 11-19, 2021**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **Draft CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.212** | **CR** |  | **rev** |  | **Current version:** | **16.7.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of Further enhancements on MIMO for NR | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_FeMIMO | | | | |  | ***Date:*** | | | 2021-11-01 |
|  |  | | | |  | |  | | |  |
| ***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 Further enhancements on MIMO for NR | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Support of Rel-17 Further enhancements on MIMO for NR | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Rel-17 Further enhancements on MIMO is not supported | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3.1.1.2, 6.3.2.1.2, 7.3.1.1.2, 7.3.1.1.3, 7.3.1.2.2, 7.3.1.2.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

##### 6.3.1.1.2 CSI only

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].

Table 6.3.1.1.2-1: PMI of *codebookType=typeI-SinglePanel*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Information field  for wideband PMI | | | Information field  for wideband PMI or per subband PMI | |
| (,) | |  |  | |
| *codebookMode*=1 | *codebookMode*=2 | *codebookMode*=1 | *codebookMode*=2 |
| Rank = 1 with >2 CSI-RS ports, | (,) | (,) | N/A | 2 | 4 |
| Rank = 1 with >2 CSI-RS ports, | (,) | (, 0) | N/A | 2 | 4 |
| Rank=2 with 4 CSI-RS ports, | (,) | (, 0) | 1 | 1 | 3 |
| Rank=2 with >4 CSI-RS ports, | (,) | (,) | 2 | 1 | 3 |
| Rank=2 with >4 CSI-RS ports, | (,) | (, 0) | 2 | 1 | 3 |
| Rank=3 or 4, with 4 CSI-RS ports | (,) | | 0 | 1 | |
| Rank=3 or 4, with 8 or 12 CSI-RS ports | (,) | | 2 | 1 | |
| Rank=3 or 4 , with >=16 CSI-RS ports | (, ) | | 2 | 1 | |
| Rank=5 or 6 | (,) | | N/A | 1 | |
| Rank=7 or 8, | (, ) | | N/A | 1 | |
| Rank=7 or 8, | (,) | | N/A | 1 | |
| Rank=7 or 8, with  or or | (,) | | N/A | 1 | |

The bitwidth for PMI of *codebookType=* *typeI-MultiPanel* is provided in Tables 6.3.1.1.2-2, where the values of and **** are given by Clause 5.2.2.2.2 in [6, TS 38.214].

Table 6.3.1.1.2-2: PMI of *codebookType=* *typeI-MultiPanel*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields for wideband | | | | | Information fields  for wideband  or per subband | | | |
| (,) |  |  |  |  |  |  |  |  |
| Rank=1 with  *codebookMode=1* | (,) | N/A | 2 | N/A | N/A | 2 | N/A | N/A | N/A |
| Rank=1 with  *codebookMode=1* | (,) | N/A | 2 | 2 | 2 | 2 | N/A | N/A | N/A |
| Rank=2 with ,  *codebookMode=1* | (,) | 1 | 2 | N/A | N/A | 1 | N/A | N/A | N/A |
| Rank=3 or 4 with ,  *codebookMode=1* | (,) | 0 | 2 | N/A | N/A | 1 | N/A | N/A | N/A |
| Rank=2 or 3 or 4 with ,  *codebookMode=1* | (,) | 2 | 2 | N/A | N/A | 1 | N/A | N/A | N/A |
| Rank=2 with ,  *codebookMode=1* | (,) | 1 | 2 | 2 | 2 | 1 | N/A | N/A | N/A |
| Rank=3 or 4 with ,  *codebookMode=1* | (,) | 0 | 2 | 2 | 2 | 1 | N/A | N/A | N/A |
| Rank=2 or 3 or 4 with ,  *codebookMode=1* | (,) | 2 | 2 | 2 | 2 | 1 | N/A | N/A | N/A |
| Rank=1 with  *codebookMode=2* | (,) | N/A | 2 | 2 | N/A | N/A | 2 | 1 | 1 |
| Rank=2 with ,  *codebookMode=2* | (,) | 1 | 2 | 2 | N/A | N/A | 1 | 1 | 1 |
| Rank=3 or 4 with ,  *codebookMode=2* | (,) | 0 | 2 | 2 | N/A | N/A | 1 | 1 | 1 |
| Rank=2 or 3 or 4 with ,  *codebookMode=2* | (,) | 2 | 2 | 2 | N/A | N/A | 1 | 1 | 1 |

The bitwidth for PMI with 1 CSI-RS port is 0.

The bitwidth for RI/LI/CQI/CRI of *codebookType=typeI-SinglePanel* is provided in Tables 6.3.1.1.2-3.

Table 6.3.1.1.2-3: RI, LI, CQI, and CRI of *codebookType=typeI-SinglePanel*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Field** | **Bitwidth** | | | | |
| **1 antenna port** | **2 antenna ports** | **4 antenna ports** | **>4 antenna ports** | |
| **Rank1~4** | **Rank5~8** |
| Rank Indicator | 0 |  |  |  |  |
| Layer Indicator | 0 |  |  |  |  |
| Wide-band CQI for the first TB | 4 | 4 | 4 | 4 | 4 |
| Wideband CQI for the second TB | 0 | 0 | 0 | 0 | 4 |
| Subband differential CQI for the first TB | 2 | 2 | 2 | 2 | 2 |
| Subband differential CQI for the second TB | 0 | 0 | 0 | 0 | 2 |
| CRI |  |  |  |  |  |

 in Table 6.3.1.1.2-3 is the number of allowed rank indicator values according to Clause 5.2.2.2.1 [6, TS 38.214].  is the value of the rank. The value of  is the number of CSI-RS resources in the corresponding resource set. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

Table 6.3.1.1.2-3A: RI, LI, CQI, and CRI associated with one CSI-RS resource pair and *csi-ReportMode= Mode 1* or *Mode 2*

|  |  |  |
| --- | --- | --- |
| **Field** | **Bitwidth** | |
| **1 antenna port** | **>1 antenna ports** |
| Rank Combination Indicator | 0 |  |
| The first Layer Indicator | 0 |  |
| The second Layer Indicator | 0 |  |
| Wide-band CQI for the first TB | 4 | 4 |
| Subband differential CQI for the first TB | 2 | 2 |
| CRI if *csi-ReportMode= Mode 1* |  |  |
| CRI if *csi-ReportMode= Mode 2* |  |  |

Table 6.3.1.1.2-3B: RI, LI, CQI, and CRI associated with one CSI-RS resource *and csi-ReportMode= Mode 1 or Mode 2*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Field** | **Bitwidth** | | | | |
| **1 antenna port** | **2 antenna ports** | **4 antenna ports** | **>4 antenna ports** | |
| **Rank1~4** | **Rank5~8** |
| Rank Indicator | 0 |  |  |  |  |
| Layer Indicator | 0 |  |  |  |  |
| Wide-band CQI for the first TB | 4 | 4 | 4 | 4 | 4 |
| Wideband CQI for the second TB | 0 | 0 | 0 | 0 | 4 |
| Subband differential CQI for the first TB | 2 | 2 | 2 | 2 | 2 |
| Subband differential CQI for the second TB | 0 | 0 | 0 | 0 | 2 |
| CRI if *csi-ReportMode= Mode 1* and *numberOfSingleTRP-CSI-Mode1 = 1* |  |  |  |  |  |
| CRI if *csi-ReportMode= Mode 1* and *numberOfSingleTRP-CSI-Mode1 = 2* | for the first CRI;  for the second CRI | for the first CRI;  for the second CRI | for the first CRI;  for the second CRI | for the first CRI;  for the second CRI | for the first CRI;  for the second CRI |
| CRI if *csi-ReportMode= Mode 2* |  |  |  |  |  |

in Table 6.3.1.1.2-3A is the number of allowed rank combination indicator values associated with one CSI-RS resource pair according to Clause 5.2.2.2.1X [6, TS 38.214]. The values of the rank combination indicator field are mapped to allowed rank combination indicator values with increasing order, where '0' is mapped to the smallest allowed value. and are the values of the first and the second rank associated with two CSI-RS resources of the CSI-RS resource pair respectively.

in Table 6.3.1.1.2-3B is the number of allowed rank indicator values associated with one CSI-RS resource according to Clause 5.2.2.2.1X [6, TS 38.214]. *v* is the value of the rank associated with the CSI-RS resource. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

The value of *N* in Table 6.3.1.1.2-3A and Table 6.3.1.1.2-3B is the number of CSI-RS resource pairs configured within a CSI-RS resource set. The values of M1 and M2 in Table 6.3.1.1.2-3A and Table 6.3.1.1.2-3B are given by

- If *sharedCMR* = “Enabled”, *M*1 = *K*1 and *M*2 = *K*2

- If *sharedCMR* is absent and *N* = 1, *M*1 = *K*1 - 1 and *M*2 = *K*2 – 1

- If *sharedCMR* is absent and *N* = 2, *M*1 = [*K*1 – 2] and [*M*2 = *K*2 – 2],

where the values of *K*1 and *K*2 are the numbers of CSI-RS resources in the first and second CSI-RS resource groups within the CSI-RS resource set respectively.

The bitwidth for RI/LI/CQI/CRI of *codebookType= typeI-MultiPanel* is provided in Table 6.3.1.1.2-4.

Table 6.3.1.1.2-4: RI, LI, CQI, and CRI of *codebookType=typeI-MultiPanel*

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator |  |
| Layer Indicator |  |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| CRI |  |

where  is the number of allowed rank indicator values according to Clause 5.2.2.2.2 [6, TS 38.214],  is the value of the rank, and  is the number of CSI-RS resources in the corresponding resource set. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

The bitwidth for RI/LI/CQI of *codebookType= typeII* or *codebookType=typeII-PortSelection* is provided in Table 6.3.1.1.2-5.

Table 6.3.1.1.2-5: RI, LI, and CQI of *codebookType=typeII or typeII-PortSelection*

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator |  |
| Layer Indicator |  |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| Indicator of the number of non-zero  wideband amplitude coefficients  for layer |  |

where  is the number of allowed rank indicator values according to Clauses 5.2.2.2.3 and 5.2.2.2.4 [6, TS 38.214] and  is the value of the rank. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

The bitwidth for CRI, SSBRI, RSRP, and differential RSRP are provided in Table 6.3.1.1.2-6.

Table 6.3.1.1.2-6: CRI, SSBRI, and RSRP

|  |  |
| --- | --- |
| Field | Bitwidth |
| CRI |  |
| SSBRI |  |
| RSRP | 7 |
| Differential RSRP | 4 |

where  is the number of CSI-RS resources in the corresponding resource set, and  is the configured number of SS/PBCH blocks in the corresponding resource set for reporting 'ssb-Index-RSRP'.

The bitwidth for CRI, SSBRI, SINR, and differential SINR are provided in Table 6.3.1.1.2-6A.

Table 6.3.1.1.2-6A: CRI, SSBRI, and SINR

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| CRI |  |
| SSBRI |  |
| SINR | 7 |
| Differential SINR | 4 |

where is the number of CSI-RS resources in the corresponding resource set, and is the configured number of SS/PBCH blocks in the corresponding resource set for reporting 'ssb-Index-SINR'.

Table 6.3.1.1.2-7: Mapping order of CSI fields of one CSI report, *pmi-FormatIndicator=widebandPMI* and *cqi-FormatIndicator=widebandCQI*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | CRI as in Tables 6.3.1.1.2-3/4, if reported |
| Rank Indicator as in Tables 6.3.1.1.2-3/4, if reported |
| Layer Indicator as in Tables 6.3.1.1.2-3/4, if reported |
| Zero padding bits , if needed |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4, if reported |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3/4, if reported |

The number of zero padding bits  in Table 6.3.1.1.2-7 is 0 for 1 CSI-RS port and  for more than 1 CSI-RS port, where

-  and  is the set of rank values  that are allowed to be reported;

- , where  is the reported rank;

- For 2 CSI-RS ports, ;

- For more than 2 CSI-RS ports, ;

- if PMI is reported,  and ; otherwise, ;

- if PMI  is reported,  is obtained according to Tables 6.3.1.1.2-1/2; otherwise, ;

- if PMI  is reported,  is obtained according to Tables 6.3.1.1.2-1/2; otherwise, ;

- if CQI is reported,  is obtained according to Tables 6.3.1.1.2-3/4; otherwise, ;

- if LI is reported,  is obtained according to Tables 6.3.1.1.2-3/4; otherwise, .

Table 6.3.1.1.2-8: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #3 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #4 as in Table 6.3.1.1.2-6, if reported |
| RSRP #1 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #3 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #4 as in Table 6.3.1.1.2-6, if reported |

Table 6.3.1.1.2-8A: Mapping order of CSI fields of one report for CRI/SINR or SSBRI/SINR reporting

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #2 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #3 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #4 as in Table 6.3.1.1.2-6A, if reported |
| SINR #1 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #2 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #3 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #4 as in Table 6.3.1.1.2-6A, if reported |

Table 6.3.1.1.2-8B: Mapping order of CSI fields of one report for group-based CRI/RSRP or SSBRI/RSRP reporting

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | Resource set indicator |
| CRI or SSBRI #1 of 1st resource group as in Table 6.3.1.1.2-6 |
| CRI or SSBRI #2 of 1st resource group as in Table 6.3.1.1.2-6 |
| CRI or SSBRI #1 of 2nd resource group as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #2 of 2nd resource group as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #1 of 3rd resource group as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #2 of 3rd resource group as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #1 of 4th resource group as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #2 of 4th resource group as in Table 6.3.1.1.2-6, if reported |
| RSRP of CRI or SSBRI #1 of 1st resource group as in Table 6.3.1.1.2-6 |
| Differential RSRP of CRI or SSBRI #2 of 1st resource group as in Table 6.3.1.1.2-6 |
| Differential RSRP of CRI or SSBRI #1 of 2nd resource group as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP of CRI or SSBRI #2 of 2nd resource group as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP of CRI or SSBRI #1 of 3rd resource group as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP of CRI or SSBRI #2 of 3rd resource group as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP of CRI or SSBRI #1 of 4th resource group as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP of CRI or SSBRI #2 of 4th resource group as in Table 6.3.1.1.2-6, if reported |

where the 1-bit resource set indicator, with value of 0 or 1, indicates the 1st or the 2nd channel measurement resource set respectively from which CRI or SSBRI #1 of 1st resource group is reported

Table 6.3.1.1.2-8C: Mapping order of CSI fields of one report for inter-cell SSBRI/RSRP reporting

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | [Measured RS Indicator] #1 [as in Table X], if reported |
| [Measured RS Indicator] #2 [as in Table X], if reported |
| [Measured RS Indicator] #3 [as in Table X], if reported |
| [Measured RS Indicator] #4 [as in Table X], if reported |
| RSRP #1 as in Table 6.3.1.1.2-6, if reported |
| [Differential] RSRP #2 as in Table 6.3.1.1.2-6, if reported |
| [Differential] RSRP #3 as in Table 6.3.1.1.2-6, if reported |
| [Differential] RSRP #4 as in Table 6.3.1.1.2-6, if reported |

Table 6.3.1.1.2-9: Mapping order of CSI fields of one CSI report, CSI part 1, *pmi-FormatIndicator=* *subbandPMI* or *cqi-FormatIndicator=subbandCQI*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 1 | CRI as in Tables 6.3.1.1.2-3/4, if reported |
| Rank Indicator as in Tables 6.3.1.1.2-3/4/5, if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4/5, if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3/4/5, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients for layer 0 as in Table 6.3.1.1.2-5, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients for layer 1 as in Table 6.3.1.1.2-5 (if the rank according to the reported RI is equal to one, this field is set to all zeros), if 2-layer PMI reporting is allowed according to the rank restriction in Clauses 5.2.2.2.3 and 5.2.2.2.4 [6, TS 38.214] and if reported |
| Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0. | |

Table 6.3.1.1.2-9A: Mapping order of CSI fields of one CSI report, CSI part 1, *csi-ReportMode= Mode 1*

Table 6.3.1.1.2-9B: Mapping order of CSI fields of one CSI report, CSI part 1, *csi-ReportMode= Mode 2*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 1 | CRI as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Rank Combination Indicator as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Rank Indicator as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Wideband CQI for the first TB as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Zero padding bits , if needed |
| Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0. | |

The number of zero padding bits in Table 6.3.1.1.2-9B is 0 for 1 CSI-RS port and for more than 1 CSI-RS port, where

- . is the set of rank and rank combination values *r* that are allowed to be reported. is obtained according to Tables 6.3.1.1.2-3A/3B for rank combination indicator and rank indicator respectively.

- is obtained according to Tables 6.3.1.1.2-3A for rank combination indicator and *R* is the reported rank combination

- is obtained according to Tables 6.3.1.1.2-3B for rank indicator and *R* is the reported rank

Table 6.3.1.1.2-10: Mapping order of CSI fields of one CSI report, CSI part 2 wideband, *pmi-FormatIndicator=* *subbandPMI* or *cqi-FormatIndicator=subbandCQI*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Wideband CQI for the second TB as in Tables 6.3.1.1.2-3/4/5, if present and reported |
| Layer Indicator as in Tables 6.3.1.1.2-3/4/5, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if *pmi-FormatIndicator=* *widebandPMI* and if reported |

Table 6.3.1.1.2-10A: Mapping order of CSI fields of one CSI report, CSI part 2 wideband, *csi-ReportMode= Mode 1*

Table 6.3.1.1.2-10B: Mapping order of CSI fields of one CSI report, CSI part 2 wideband, *csi-ReportMode= Mode 2*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource |
| Two Layer Indicators as in Table 6.3.1.1.2-3A, if reported part 1 is associated with one CSI-RS resource pair, where the first Layer Indicator and the second Layer Indicator are associated with the first resource and the second resource within the resource pair respectively;  Layer Indicator as in Table 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the first resource within the CSI-RS resource pair, if reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] associated with the first CSI-RS resource within the CSI-RS resource pair, if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the second CSI-RS resource within the CSI-RS resource pair, if reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] associated with the second CSI-RS resource within the CSI-RS resource pair, if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if reported part 1 is associated with one CSI-RS resource |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource |

Table 6.3.1.1.2-11: Mapping order of CSI fields of one CSI report, CSI part 2 subband, *pmi-FormatIndicator=* *subbandPMI* or *cqi-FormatIndicator=subbandCQI*

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | Subband differential CQI for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4/5, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields  of all even subbands with increasing order of subband number, from left to right as in Tables 6.3.1.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] of all even subbands with increasing order of subband number, if *pmi-FormatIndicator=* *subbandPMI* and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4/5, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields  of all odd subbands with increasing order of subband number, from left to right as in Tables 6.3.1.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] of all odd subbands with increasing order of subband number, if *pmi-FormatIndicator=* *subbandPMI* and if reported |

Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0.

Table 6.3.1.1.2-11A: Mapping order of CSI fields of one CSI report, CSI part 2 subband, *csi-ReportMode= Mode 1*

Table 6.3.1.1.2-11B: Mapping order of CSI fields of one CSI report, CSI part 2 subband, *csi-ReportMode= Mode 2*

If none of the CSI reports for transmission on a PUCCH is of two parts, the CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-12, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to.

Table 6.3.1.1.2-12: Mapping order of CSI reports to UCI bit sequence , without two-part CSI report(s)

|  |  |
| --- | --- |
| UCI bit sequence | CSI report number |
|  | CSI report #1  as in Table 6.3.1.1.2-7/8 |
| CSI report #2  as in Table 6.3.1.1.2-7/8 |
| … |
| CSI report #n  as in Table 6.3.1.1.2-7/8 |

If at least one of the CSI reports for transmission on a PUCCH is of two parts, two UCI bit sequences are generated,  and . The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-13, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to. The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.1.1.2-14, are mapped to the UCI bit sequence  starting with . The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to . If the length of UCI bit sequence  is less than 3 bits, zeros shall be appended to the UCI bit sequence until its length equals 3.

Table 6.3.1.1.2-13: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)

|  |  |
| --- | --- |
| UCI bit sequence | CSI report number |
|  | CSI report #1 if CSI report #1 is not of two parts, or  CSI report #1, CSI part 1, if CSI report #1 is of two parts,  as in Table 6.3.1.1.2-7/8/9 |
| CSI report #2 if CSI report #2 is not of two parts, or  CSI report #2, CSI part 1, if CSI report #2 is of two parts,  as in Table 6.3.1.1.2-7/8/9 |
| … |
| CSI report #n if CSI report #n is not of two parts, or  CSI report #n, CSI part 1, if CSI report #n is of two parts,  as in Table 6.3.1.1.2-7/8/9 |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.1.1.2-13 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

Table 6.3.1.1.2-14: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)

|  |  |
| --- | --- |
| UCI bit sequence | CSI report number |
|  | CSI report #1, CSI part 2 wideband, as in Table 6.3.1.1.2-10 if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.1.1.2-10 if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.1.1.2-10 if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.1.1.2-11 if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.1.1.2-11  if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.1.1.2-11  if CSI part 2 exists for CSI report #n |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.1.1.2-14 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

< Unchanged parts are omitted >

##### 6.3.2.1.2 CSI

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].

Table 6.3.2.1.2-1: PMI of *codebookType=* *typeII*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields  for wideband PMI | | | | | | Information fields  for wideband PMI or per subband PMI | | | |
|  |  |  |  |  |  |  |  |  |  |
| Rank=1  SBAmp off |  |  |  |  | N/A | N/A |  | N/A | N/A | N/A |
| Rank=2  SBAmp off |  |  |  |  |  |  |  |  | N/A | N/A |
| Rank=1  SBAmp on |  |  |  |  | N/A | N/A |  | N/A |  | N/A |
| Rank=2  SBAmp on |  |  |  |  |  |  |  |  |  |  |

The bitwidth for PMI of *codebookType=typeII-r16* is provided in Tables 6.3.2.1.2-1A, where the values of , , , , , and are given by Clause 5.2.2.2.5 in [6, TS 38.214].

Table 6.3.2.1.2-1A: PMI of *codebookType=* *typeII-r16*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | Information fields | | | | | | | | | | | | | | | |
|  | | | |  | |  | | |  | |  | | |  | |
| Rank=1 | | |  | | | |  | |  | | | N/A | | N/A | | | N/A | |
| Rank=2 | | |  | | | |  | |  | | |  | | N/A | | | N/A | |
| Rank=3 | | |  | | | |  | |  | | |  | |  | | | N/A | |
| Rank=4 | | |  | | | |  | |  | | |  | |  | | |  | |
| Rank=1 | | |  | | | |  | |  | | | N/A | | N/A | | | N/A | |
| Rank=2 | | |  | | | |  | |  | | |  | | N/A | | | N/A | |
| Rank=3 | | |  | | | |  | |  | | |  | |  | | | N/A | |
| Rank=4 | | |  | | | |  | |  | | |  | |  | | |  | |
|  | Information fields | | | | | | | | | | | | | | | | | |
|  |  | |  |  |  | |  | |  |  | |  | |  |  | |  |
| Rank=1 | 4 | N/A | | N/A | N/A | N/A | |  | | N/A | N/A | | N/A | |  |  | |  |
| Rank=2 | 4 | 4 | | N/A | N/A | N/A | |  | |  | N/A | | N/A | |  |  | |  |
| Rank=3 | 4 | 4 | | 4 | N/A | N/A | |  | |  |  | | N/A | |  |  | |  |
| Rank=4 | 4 | 4 | | 4 | 4 | N/A | |  | |  |  | |  | |  |  | |  |
| Rank=1 | 4 | N/A | | N/A | N/A |  | |  | | N/A | N/A | | N/A | |  |  | |  |
| Rank=2 | 4 | 4 | | N/A | N/A |  | |  | |  | N/A | | N/A | |  |  | |  |
| Rank=3 | 4 | 4 | | 4 | N/A |  | |  | |  |  | | N/A | |  |  | |  |
| Rank=4 | 4 | 4 | | 4 | 4 |  | |  | |  |  | |  | |  |  | |  |

Note: the bitwidth for , and shown in Table 6.3.2.1.2-1A is the total bitwidth of , and up to Rank = , respectively, and the corresponding per layer bitwidths are , , and 4, (i.e., 1, 3, and 4 bits for each respective indicator elements , , and , respectively), where as defined in Clause 5.2.2.2.5 in [6, TS 38.214] is the number of nonzero coefficients for layer such that .

The bitwidth for PMI of *codebookType= typeII-PortSelection* is provided in Tables 6.3.2.1.2-2, where the values of , , , , , , and  are given by Clause 5.2.2.2.4 in [6, TS 38.214].

Table 6.3.2.1.2-2: PMI of *codebookType=* *typeII-PortSelection*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields  for wideband PMI | | | | | Information fields  for wideband PMI or per subband PMI | | | |
|  |  |  |  |  |  |  |  |  |
| Rank=1  SBAmp off |  |  |  | N/A | N/A |  | N/A | N/A | N/A |
| Rank=2  SBAmp off |  |  |  |  |  |  |  | N/A | N/A |
| Rank=1  SBAmp on |  |  |  | N/A | N/A |  | N/A |  | N/A |
| Rank=2  SBAmp on |  |  |  |  |  |  |  |  |  |

The bitwidth for PMI of *codebookType=typeII-PortSelection-r16* is provided in Tables 6.3.2.1.2-2A, where the values of ,, , , , and are given by Clause 5.2.2.2.6 in [6, TS 38.214].

Table 6.3.2.1.2-2A: PMI of *codebookType=* *typeII-PortSelection-r16*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | Information fields | | | | | | | | | | | | | |
|  | | | |  | |  | | |  | |  | | |
| Rank=1 | | | |  | | | |  | | N/A | | | N/A | | N/A | | |
| Rank=2 | | | |  | | | |  | |  | | | N/A | | N/A | | |
| Rank=3 | | | |  | | | |  | |  | | |  | | N/A | | |
| Rank=4 | | | |  | | | |  | |  | | |  | |  | | |
| Rank=1 | | | |  | | | |  | | N/A | | | N/A | | N/A | | |
| Rank=2 | | | |  | | | |  | |  | | | N/A | | N/A | | |
| Rank=3 | | | |  | | | |  | |  | | |  | | N/A | | |
| Rank=4 | | | |  | | | |  | |  | | |  | |  | | |
|  | Information fields | | | | | | | | | | | | | | | | |
|  |  |  | |  |  |  | |  | |  |  | |  | |  |  |
| Rank=1 | 4 | N/A | N/A | | N/A | N/A |  | | N/A | | N/A | N/A | |  | |  |  |
| Rank=2 | 4 | 4 | N/A | | N/A | N/A |  | |  | | N/A | N/A | |  | |  |  |
| Rank=3 | 4 | 4 | 4 | | N/A | N/A |  | |  | |  | N/A | |  | |  |  |
| Rank=4 | 4 | 4 | 4 | | 4 | N/A |  | |  | |  |  | |  | |  |  |
| Rank=1 | 4 | N/A | N/A | | N/A |  |  | | N/A | | N/A | N/A | |  | |  |  |
| Rank=2 | 4 | 4 | N/A | | N/A |  |  | |  | | N/A | N/A | |  | |  |  |
| Rank=3 | 4 | 4 | 4 | | N/A |  |  | |  | |  | N/A | |  | |  |  |
| Rank=4 | 4 | 4 | 4 | | 4 |  |  | |  | |  |  | |  | |  |  |

Note: the bitwidth for , and shown in Table 6.3.2.1.2-2A is the total bitwidth of , and up to Rank = , respectively, and the corresponding per layer bitwidths are , , and 4, (i.e., 1, 3, and 4 bits for each respective indicator elements , , and , respectively), where as defined in Clause 5.2.2.2.5 in [6, TS 38.214] is the number of nonzero coefficients for layer such that .

The bitwidth for PMI of *codebookType=typeII-PortSelection-r17* is provided in Tables 6.3.2.1.2-2B, where the values of ,, , , and are given by Clause 5.2.2.2.x in [6, TS 38.214].

Table 6.3.2.1.2-2B: PMI of *codebookType=* *typeII-PortSelection-r17*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields | | | | | | | | | |
|  | |  | |  | |  | |  | |
| Rank=1 |  | |  | | N/A | | N/A | | N/A | |
| Rank=2 |  | |  | |  | | N/A | | N/A | |
| Rank=3 |  | |  | |  | |  | | N/A | |
| Rank=4 |  | |  | |  | |  | |  | |
|  | Information fields | | | | | | | | | |
|  |  |  |  |  |  | |  | |  |
| Rank=1 | 4 | N/A | N/A | N/A | N/A if M=1; othereise |  | |  | | N/A if ;  otherwise |
| Rank=2 | 4 | 4 | N/A | N/A | N/A if M=1; othereise |  | |  | | N/A if ;  otherwise |
| Rank=3 | 4 | 4 | 4 | N/A | N/A if M=1; othereise |  | |  | |  |
| Rank=4 | 4 | 4 | 4 | 4 | N/A if M=1; othereise |  | |  | |  |

Note: the bitwidth for , and shown in Table 6.3.2.1.2-2B is the total bitwidth of , and up to Rank = , respectively, and the corresponding per layer bitwidths are , , and 4, (i.e., 1, 3, and 4 bits for each respective indicator elements , , and , respectively), where as defined in Clause 5.2.2.2.x in [6, TS 38.214] is the number of nonzero coefficients for layer such that .

For CSI on PUSCH, two UCI bit sequences are generated,  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 UCI bit sequence  starting with . The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-7, are mapped to the UCI bit sequence  starting with .

The mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP reporting is provided in Table 6.3.1.1.2-8. The mapping order of CSI fields of one report for CRI/SINR or SSBRI/SINR reporting is provided in Table 6.3.1.1.2-8A. The mapping order of CSI fields of one report for group-based CRI/RSRP or SSBRI/RSRP reporting is provided in Table 6.3.1.1.2-8B. The mapping order of CSI fields of one report for inter-cell SSBRI/RSRP reporting is provided in Table 6.3.1.1.2-8C. The procedure in clause 6.3.2 described for CSI part 1 is also applicable for one report for CRI/RSRP, SSBRI/RSRP, CRI/SINR, or SSBRI/SINR reporting.

Table 6.3.2.1.2-3: Mapping order of CSI fields of one CSI report, CSI part 1

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 1 | CRI as in Tables 6.3.1.1.2-3/4/6, if reported |
| Rank Indicator as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8 or 6.3.2.1.2-9, if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8 or 6.3.2.1.2-9, if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8 or 6.3.2.1.2-9, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients for layer 0 as in Table 6.3.1.1.2-5, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients for layer 1 as in Table 6.3.1.1.2-5 (if the rank according to the reported RI is equal to one, this field is set to all zeros), if 2-layer PMI reporting is allowed according to the rank restriction in Clauses 5.2.2.2.3 and 5.2.2.2.4 [6, TS 38.214] and if reported |
| Indicator of the total number of non-zero coefficients summed across all layers as in Table 6.3.2.1.2-8 or 6.3.2.1.2-9, if reported |
| Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0. | |

Table 6.3.2.1.2-3A: Mapping order of CSI fields of one CSI report, CSI part 1, *csi-ReportMode= Mode 1*

Table 6.3.2.1.2-3B: Mapping order of CSI fields of one CSI report, CSI part 1, *csi-ReportMode= Mode 2*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 1 | CRI as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Rank Combination Indicator as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Rank Indicator as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Wideband CQI for the first TB as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair;  Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource |
| Zero padding bits , if needed |
| Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0. | |

The number of zero padding bits in Table 6.3.1.1.2-9B is 0 for 1 CSI-RS port and for more than 1 CSI-RS port, where

- . is the set of rank and rank combination values *r* that are allowed to be reported. is obtained according to Tables 6.3.1.1.2-3A/3B for rank combination indicator and rank indicator respectively.

- is obtained according to Tables 6.3.1.1.2-3A for rank combination indicator and *R* is the reported rank combination

- is obtained according to Tables 6.3.1.1.2-3B for rank indicator and *R* is the reported rank

Table 6.3.2.1.2-4: Mapping order of CSI fields of one CSI report, CSI part 2 wideband

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Wideband CQI for the second TB as in Tables 6.3.1.1.2-3/4/5, if present and reported |
| Layer Indicator as in Tables 6.3.1.1.2-3/4/5, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if *pmi-FormatIndicator=* *widebandPMI* and if reported |

Table 6.3.2.1.2-4A: Mapping order of CSI fields of one CSI report, CSI part 2 wideband, *csi-ReportMode= Mode 1*

Table 6.3.2.1.2-4B: Mapping order of CSI fields of one CSI report, CSI part 2 wideband, *csi-ReportMode= Mode 2*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource |
| Two Layer Indicators as in Table 6.3.1.1.2-3A, if reported part 1 is associated with one CSI-RS resource pair, where the first Layer Indicator and the second Layer Indicator are associated with the first resource and the second resource within the resource pair respectively;  Layer Indicator as in Table 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the first resource within the CSI-RS resource pair, if reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] associated with the first CSI-RS resource within the CSI-RS resource pair, if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the second CSI-RS resource within the CSI-RS resource pair, if reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] associated with the second CSI-RS resource within the CSI-RS resource pair, if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource pair |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if reported part 1 is associated with one CSI-RS resource |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if *pmi-FormatIndicator=* *widebandPMI* and reported part 1 is associated with one CSI-RS resource |

Table 6.3.2.1.2-5: Mapping order of CSI fields of one CSI report, CSI part 2 subband

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | Subband differential CQI for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4/5, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields  of all even subbands with increasing order of subband number, from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] of all even subbands with increasing order of subband number, if *pmi-FormatIndicator=* *subbandPMI* and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4/5, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields  of all odd subbands with increasing order of subband number, from left to right as in Tables 6.3.1.1.2-1/2 or 6.3.2.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214] of all odd subbands with increasing order of subband number, if *pmi-FormatIndicator=* *subbandPMI* and if reported |

Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0.

Table 6.3.2.1.2-5A: Mapping order of CSI fields of one CSI report, CSI part 2 of *codebookType=typeII-r16 or typeII-PortSelection-r16*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Tables 6.3.2.1.2-1A/2A, if reported |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A:, , and highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported |

Table 6.3.2.1.2-5B: Mapping order of CSI fields of one CSI report, CSI part 2 of *codebookType=typeII-PortSelection-r17*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Tables 6.3.2.1.2-2B, if reported |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-2B:, and highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on function defined in clause 5.2.x of TS38.214, if reported |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-2B lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on function defined in clause 5.2.x of TS38.214, if reported |

Table 6.3.2.1.2-5C: Mapping order of CSI fields of one CSI report, CSI part 2 subband, *ReportMode= Mode 1*

Table 6.3.2.1.2-5D: Mapping order of CSI fields of one CSI report, CSI part 2 subband, *ReportMode= Mode 2*

Table 6.3.2.1.2-6: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)

|  |  |
| --- | --- |
| UCI bit sequence | CSI report number |
|  | CSI part 1 of CSI report #1 as in Table 6.3.2.1.2-3 or Table Table 6.3.2.1.2-3A or Table 6.3.2.1.2-3B or Table 6.3.1.1.2-8 or Table 6.3.1.1.2-8A or Table 6.3.1.1.2-8B or Table 6.3.1.1.2-8C |
| CSI part 1 of CSI report #2 as in Table 6.3.2.1.2-3 or Table Table 6.3.2.1.2-3A or Table 6.3.2.1.2-3B or Table 6.3.1.1.2-8 or Table 6.3.1.1.2-8A or Table 6.3.1.1.2-8B or Table 6.3.1.1.2-8C |
| … |
| CSI part 1 of CSI report #n as in Table 6.3.2.1.2-3 or Table Table 6.3.2.1.2-3A or Table 6.3.2.1.2-3B or Table 6.3.1.1.2-8 or Table 6.3.1.1.2-8A or Table 6.3.1.1.2-8B or Table 6.3.1.1.2-8C |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.2.1.2-6 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

Table 6.3.2.1.2-7: Mapping order of CSI reports to UCI bit sequence ,   
with two-part CSI report(s)

|  |  |
| --- | --- |
| UCI bit sequence | CSI report number |
|  | CSI report #1, CSI part 2 wideband, as in Table 6.3.2.1.2-4,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.2.1.2-4,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B, if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.2.1.2-4,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B, if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.2.1.2-5,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.2.1.2-5,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B,  if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.2.1.2-5,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A or Table 6.3.2.1.2-5B,  if CSI part 2 exists for CSI report #n |

where CSI report #1, CSI report #2, …, CSI report #n in Table 6.3.2.1.2-7 correspond to the CSI reports in increasing order of CSI report priority values according to Clause 5.2.5 of [6, TS38.214].

The bitwidth for RI/CQI of *codebookType= typeII-r16* or *codebookType=typeII-PortSelection-r16* is provided in Table 6.3.2.1.2-8.

Table 6.3.2.1.2-8: RI and CQI of *codebookType=typeII-r16 or typeII-PortSelection-r16*

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator |  |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| Indicator of the total number of non-zero coefficients summed across all layers | if max allowed rank is 1;  otherwise |

where is the number of allowed rank indicator values according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214],, where , , , and are given by Clause 5.2.2.2.5 and 5.2.2.2.6 in [6, TS 38.214]. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

Table 6.3.2.1.2-9: RI and CQI of *codebookType=typeII-PortSelection-r17*

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator |  |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| Indicator of the total number of non-zero coefficients summed across all layers | if max allowed rank is 1;  otherwise |

where is the number of allowed rank indicator values according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214],, where , , and are given by Clause 5.2.2.2.x in [6, TS 38.214]. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where '0' is mapped to the smallest allowed rank indicator value.

< 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. 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:

- 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.

- HARQ process number – 4 bits

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

- 1 bit for semi-static HARQ-ACK codebook;

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

- 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 = codebook*, 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 SRS resource set indicated by SRS resource set indicator field, 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 SRS resource set indicated by SRS resource set indicator field.

- 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.

- 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*;

- 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*;

- 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 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.

- 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 .

- 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;

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

- 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 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. When the SRS resource set indicator field is present and *maxRank=2*, the MSB indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers, and the LSB indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator and/or Second Precoding information.

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.

- 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 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.

- 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 recerive 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; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

- 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 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.

- 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.

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.

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 |

Table 7.3.1.1.2-2: Precoding information and number of layers, for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2 or 3 or 4, and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … | … | … |
| 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 |
| 4 | 2 layers: TPMI=0 | 4 | 2 layers: TPMI=0 | 4 | 2 layers: TPMI=0 |
| … | … | … | … | … | … |
| 9 | 2 layers: TPMI=5 | 9 | 2 layers: TPMI=5 | 9 | 2 layers: TPMI=5 |
| 10 | 3 layers: TPMI=0 | 10 | 3 layers: TPMI=0 | 10 | 3 layers: TPMI=0 |
| 11 | 4 layers: TPMI=0 | 11 | 4 layers: TPMI=0 | 11 | 4 layers: TPMI=0 |
| 12 | 1 layer: TPMI=4 | 12 | 1 layer: TPMI=4 | 12-15 | reserved |
| … | … | … | … |  |  |
| 19 | 1 layer: TPMI=11 | 19 | 1 layer: TPMI=11 |  |  |
| 20 | 2 layers: TPMI=6 | 20 | 2 layers: TPMI=6 |  |  |
| … | … | … | … |  |  |
| 27 | 2 layers: TPMI=13 | 27 | 2 layers: TPMI=13 |  |  |
| 28 | 3 layers: TPMI=1 | 28 | 3 layers: TPMI=1 |  |  |
| 29 | 3 layers: TPMI=2 | 29 | 3 layers: TPMI=2 |  |  |
| 30 | 4 layers: TPMI=1 | 30 | 4 layers: TPMI=1 |  |  |
| 31 | 4 layers: TPMI=2 | 31 | 4 layers: TPMI=2 |  |  |
| 32 | 1 layers: TPMI=12 |  |  |  |  |
| … | … |  |  |  |  |
| 47 | 1 layers: TPMI=27 |  |  |  |  |
| 48 | 2 layers: TPMI=14 |  |  |  |  |
| … | … |  |  |  |  |
| 55 | 2 layers: TPMI=21 |  |  |  |  |
| 56 | 3 layers: TPMI=3 |  |  |  |  |
| … | … |  |  |  |  |
| 59 | 3 layers: TPMI=6 |  |  |  |  |
| 60 | 4 layers: TPMI=3 |  |  |  |  |
| 61 | 4 layers: TPMI=4 |  |  |  |  |
| 62-63 | reserved |  |  |  |  |

Table 7.3.1.1.2-2A: Precoding information and number of layers for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 |
| 4 | 2 layers: TPMI=0 | 4 | 2 layers: TPMI=0 |
| … | … | … | … |
| 9 | 2 layers: TPMI=5 | 9 | 2 layers: TPMI=5 |
| 10 | 1 layer: TPMI=13 | 10 | 1 layer: TPMI=13 |
| 11 | 2 layer: TPMI=6 | 11 | 2 layer: TPMI=6 |
| 12 | 1 layer: TPMI=4 | 12-15 | Reserved |
| … | … |  |  |
| 20 | 1 layer: TPMI=12 |  |  |
| 21 | 1 layer: TPMI=14 |  |  |
| 22 | 1 layer: TPMI=15 |  |  |
| 23 | 2 layers: TPMI=7 |  |  |
| … | … |  |  |
| 29 | 2 layers: TPMI=13 |  |  |
| 30-31 | Reserved |  |  |

Table 7.3.1.1.2-2B: Precoding information and number of layers for 4 antenna ports, if transform precoder is disabled, *maxRank* = 3 or 4, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 |
| 4 | 2 layers: TPMI=0 | 4 | 2 layers: TPMI=0 |
| … | … | … | … |
| 9 | 2 layers: TPMI=5 | 9 | 2 layers: TPMI=5 |
| 10 | 3 layers: TPMI=0 | 10 | 3 layers: TPMI=0 |
| 11 | 4 layers: TPMI=0 | 11 | 4 layers: TPMI=0 |
| 12 | 1 layer: TPMI=13 | 12 | 1 layer: TPMI=13 |
| 13 | 2 layer: TPMI=6 | 13 | 2 layer: TPMI=6 |
| 14 | 3 layer: TPMI=1 | 14 | 3 layer: TPMI=1 |
| 15 | 1 layer: TPMI=4 | 15 | Reserved |
| … | … |  |  |
| 23 | 1 layer: TPMI=12 |  |  |
| 24 | 1 layer: TPMI=14 |  |  |
| 25 | 1 layer: TPMI=15 |  |  |
| 26 | 2 layers: TPMI=7 |  |  |
| … | … |  |  |
| 32 | 2 layers: TPMI=13 |  |  |
| 33 | 3 layers: TPMI=2 |  |  |
| 34 | 4 layers: TPMI=1 |  |  |
| 35 | 4 layers: TPMI=2 |  |  |
| 36-63 | Reserved |  |  |

Table 7.3.1.1.2-2C: Second precoding information, for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2 or 3 or 4, and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … |
| 27 | 1 layer: TPMI=27 | 11 | 1 layer: TPMI=11 | 3 | 1 layer: TPMI=3 |
| 28-31 | 1 layer: reserved | 12-15 | 1 layer: reserved | 4-7 | 1 layer: reserved |
| 0 | 2 layers: TPMI=0 | 0 | 2 layers: TPMI=0 | 0 | 2 layers: TPMI=0 |
| … | … | … | … | … | … |
| 21 | 2 layers: TPMI=21 | 13 | 2 layers: TPMI=13 | 5 | 2 layers: TPMI=5 |
| 22-31 | 2 layers: reserved | 14-15 | 2 layers: reserved | 6-7 | 2 layers: reserved |
| 0 | 3 layers: TPMI=0 | 0 | 3 layers: TPMI=0 | 0 | 3 layers: TPMI=0 |
| … | … | … | … | 1-7 | 3 layers: reserved |
| 6 | 3 layers: TPMI=6 | 2 | 3 layers: TPMI=2 | 0 | 4 layers: TPMI=0 |
| 7-31 | 3 layers: reserved | 3-15 | 3 layers: reserved | 1-7 | 4 layers: reserved |
| 0 | 4 layers: TPMI=0 | 0 | 4 layers: TPMI=0 |  |  |
| … | … | … | … |  |  |
| 4 | 4 layers: TPMI=4 | 2 | 4 layers: TPMI=2 |  |  |
| 5-31 | 4 layers: reserved | 3-15 | 4 layers: reserved |  |  |

Table 7.3.1.1.2-2D: Second precoding information for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … |
| 15 | 1 layer: TPMI=15 | 13 | 1 layer: TPMI=13 |
| 0 | 2 layers: TPMI=0 | 14-15 | 1 layer: reserved |
| … | … | 0 | 2 layers: TPMI=0 |
| 13 | 2 layers: TPMI=13 | … | … |
| 14-15 | 2 layers: reserved | 6 | 2 layers: TPMI=6 |
|  |  | 7-15 | 2 layers: reserved |

Table 7.3.1.1.2-2E: Second precoding information for 4 antenna ports, if transform precoder is disabled, *maxRank* = 3 or 4, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … |
| 15 | 1 layer: TPMI=15 | 13 | 1 layer: TPMI=13 |
| 0 | 2 layers: TPMI=0 | 14-15 | 1 layer: reserved |
| … | … | 0 | 2 layers: TPMI=0 |
| 13 | 2 layers: TPMI=13 | … | … |
| 14-15 | 2 layers: reserved | 6 | 2 layers: TPMI=6 |
| 0 | 3 layers: TPMI=0 | 7-15 | 2 layers: reserved |
| … | … | 0 | 3 layers: TPMI=0 |
| 2 | 3 layers: TPMI=2 | 1 | 3 layer: TPMI=1 |
| 3-15 | 3 layers: reserved | 2-15 | 3 layers: reserved |
| 0 | 4 layers: TPMI=0 | 0 | 4 layers: TPMI=0 |
| … | … | 1-15 | 4 layers: reserved |
| 2 | 4 layers: TPMI=2 |  |  |
| 3-15 | 4 layers: reserved |  |  |

Table 7.3.1.1.2-3: Precoding information and number of layers for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission* is either not configured or configured to *fullpowerMode2*, or if transform precoder is disabled, *maxRank* = 1, and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … | … | … |
| 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 |
| 4 | 1 layer: TPMI=4 | 4 | 1 layer: TPMI=4 |  |  |
| … | … | … | … |  |  |
| 11 | 1 layer: TPMI=11 | 11 | 1 layer: TPMI=11 |  |  |
| 12 | 1 layers: TPMI=12 | 12-15 | reserved |  |  |
| … | … |  |  |  |  |
| 27 | 1 layers: TPMI=27 |  |  |  |  |
| 28-31 | reserved |  |  |  |  |

Table 7.3.1.1.2-3A: Precoding information and number of layers for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission = fullpowerMode1*, or if transform precoder is disabled, *maxRank* = 1, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset*= *partialAndNonCoherent* | Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 3 | 1 layer: TPMI=3 | 3 | 1 layer: TPMI=3 |
| 4 | 1 layer: TPMI=13 | 4 | 1 layer: TPMI=13 |
| 5 | 1 layer: TPMI=4 | 5-7 | Reserved |
| … | … |  |  |
| 13 | 1 layer: TPMI=12 |  |  |
| 14 | 1 layer: TPMI=14 |  |  |
| 15 | 1 layer: TPMI=15 |  |  |

Table 7.3.1.1.2-4: Precoding information and number of layers, for 2 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset* = *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| 2 | 2 layers: TPMI=0 | 2 | 2 layers: TPMI=0 |
| 3 | 1 layer: TPMI=2 | 3 | reserved |
| 4 | 1 layer: TPMI=3 |  |  |
| 5 | 1 layer: TPMI=4 |  |  |
| 6 | 1 layer: TPMI=5 |  |  |
| 7 | 2 layers: TPMI=1 |  |  |
| 8 | 2 layers: TPMI=2 |  |  |
| 9-15 | reserved |  |  |

Table 7.3.1.1.2-4A: Precoding information and number of layers, for 2 antenna ports, if transform precoder is disabled*, maxRank* = 2, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |
| --- | --- |
| Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 |
| 2 | 2 layers: TPMI=0 |
| 3 | 1 layer: TPMI=2 |

Table 7.3.1.1.2-4B: Second precoding information, for 2 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset* = *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | 0 | 2 layers: TPMI=0 |
| 5 | 1 layer: TPMI=5 | 1 | 2 layers: reserved |
| 6-7 | 1 layer: reserved |  |  |
| 0 | 2 layers: TPMI=0 |  |  |
| … | … |  |  |
| 2 | 2 layers: TPMI=2 |  |  |
| 3-7 | 2 layers: reserved |  |  |

Table 7.3.1.1.2-4C: Second precoding information, for 2 antenna ports, if transform precoder is disabled*, maxRank* = 2, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |
| --- | --- |
| Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 |
| … | … |
| 2 | 1 layer: TPMI=2 |
| 3 | 1 layer: reserved |
| 0 | 2 layers: TPMI=0 |
| 1-3 | 2 layers: reserved |

Table 7.3.1.1.2-5: Precoding information and number of layers, for 2 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, or if transform precoder is disabled, *maxRank* = 1, and and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *codebookSubset* = *fullyAndPartialAndNonCoherent* | Bit field mapped to index | *codebookSubset* = *nonCoherent* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| 2 | 1 layer: TPMI=2 |  |  |
| 3 | 1 layer: TPMI=3 |  |  |
| 4 | 1 layer: TPMI=4 |  |  |
| 5 | 1 layer: TPMI=5 |  |  |
| 6-7 | reserved |  |  |

Table 7.3.1.1.2-5A: Precoding information and number of layers, for 2 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission = fullpowerMode1*, or if transform precoder is disabled*, maxRank* = 1, and *ul-FullPowerTransmission = fullpowerMode1*

|  |  |
| --- | --- |
| Bit field mapped to index | *codebookSubset*= *nonCoherent* |
| 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 |
| 2 | 1 layer: TPMI=2 |
| 3 | Reserved |

Table 7.3.1.1.2-6: Antenna port(s), transform precoder is enabled, *dmrs-Type*=1, *maxLength*=1, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2-BPSK modulation is used

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0 |
| 1 | 2 | 1 |
| 2 | 2 | 2 |
| 3 | 2 | 3 |

Table 7.3.1.1.2-6A: Antenna port(s), transform precoder is enabled, *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2-BPSK modulation is used, *dmrs-Type*=1, *maxLength*=1

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0, nSCID= 0 |
| 1 | 2 | 0, nSCID= 1 |
| 2 | 2 | 2, nSCID= 0 |
| 3 | 2 | 2, nSCID= 1 |

Table 7.3.1.1.2-7: Antenna port(s), transform precoder is enabled, *dmrs-Type*=1, *maxLength*=2, except that *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured and π/2-BPSK modulation is used

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0 | 1 |
| 1 | 2 | 1 | 1 |
| 2 | 2 | 2 | 1 |
| 3 | 2 | 3 | 1 |
| 4 | 2 | 0 | 2 |
| 5 | 2 | 1 | 2 |
| 6 | 2 | 2 | 2 |
| 7 | 2 | 3 | 2 |
| 8 | 2 | 4 | 2 |
| 9 | 2 | 5 | 2 |
| 10 | 2 | 6 | 2 |
| 11 | 2 | 7 | 2 |
| 12-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-7A: Antenna port(s), transform precoder is enabled, *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2-BPSK modulation is used, *dmrs-Type=1, maxLength=2*

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0, nSCID= 0 | 1 |
| 1 | 2 | 0, nSCID= 1 | 1 |
| 2 | 2 | 2, nSCID= 0 | 1 |
| 3 | 2 | 2, nSCID= 1 | 1 |
| 4 | 2 | 0, nSCID= 0 | 2 |
| 5 | 2 | 0, nSCID= 1 | 2 |
| 6 | 2 | 2, nSCID= 0 | 2 |
| 7 | 2 | 2, nSCID= 1 | 2 |
| 8 | 2 | 4, nSCID= 0 | 2 |
| 9 | 2 | 4, nSCID= 1 | 2 |
| 10 | 2 | 6, nSCID= 0 | 2 |
| 11 | 2 | 6, nSCID= 1 | 2 |
| 12-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-8: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=1, rank = 1

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| 2 | 2 | 0 |
| 3 | 2 | 1 |
| 4 | 2 | 2 |
| 5 | 2 | 3 |
| 6-7 | Reserved | Reserved |

Table 7.3.1.1.2-9: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=1, rank = 2

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0,1 |
| 1 | 2 | 0,1 |
| 2 | 2 | 2,3 |
| 3 | 2 | 0,2 |
| 4-7 | Reserved | Reserved |

Table 7.3.1.1.2-10: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=1, rank = 3

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-2 |
| 1-7 | Reserved | Reserved |

Table 7.3.1.1.2-11: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=1, rank = 4

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-3 |
| 1-7 | Reserved | Reserved |

Table 7.3.1.1.2-12: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=2, rank = 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 0 | 1 |
| 3 | 2 | 1 | 1 |
| 4 | 2 | 2 | 1 |
| 5 | 2 | 3 | 1 |
| 6 | 2 | 0 | 2 |
| 7 | 2 | 1 | 2 |
| 8 | 2 | 2 | 2 |
| 9 | 2 | 3 | 2 |
| 10 | 2 | 4 | 2 |
| 11 | 2 | 5 | 2 |
| 12 | 2 | 6 | 2 |
| 13 | 2 | 7 | 2 |
| 14-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-13: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=2, rank = 2

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0,1 | 1 |
| 1 | 2 | 0,1 | 1 |
| 2 | 2 | 2,3 | 1 |
| 3 | 2 | 0,2 | 1 |
| 4 | 2 | 0,1 | 2 |
| 5 | 2 | 2,3 | 2 |
| 6 | 2 | 4,5 | 2 |
| 7 | 2 | 6,7 | 2 |
| 8 | 2 | 0,4 | 2 |
| 9 | 2 | 2,6 | 2 |
| 10-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-14: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=2, rank = 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0-2 | 1 |
| 1 | 2 | 0,1,4 | 2 |
| 2 | 2 | 2,3,6 | 2 |
| 3-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-15: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *maxLength*=2, rank = 4

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0-3 | 1 |
| 1 | 2 | 0,1,4,5 | 2 |
| 2 | 2 | 2,3,6,7 | 2 |
| 3 | 2 | 0,2,4,6 | 2 |
| 4-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-16: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=1, rank=1

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| 2 | 2 | 0 |
| 3 | 2 | 1 |
| 4 | 2 | 2 |
| 5 | 2 | 3 |
| 6 | 3 | 0 |
| 7 | 3 | 1 |
| 8 | 3 | 2 |
| 9 | 3 | 3 |
| 10 | 3 | 4 |
| 11 | 3 | 5 |
| 12-15 | Reserved | Reserved |

Table 7.3.1.1.2-17: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=1, rank=2

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0,1 |
| 1 | 2 | 0,1 |
| 2 | 2 | 2,3 |
| 3 | 3 | 0,1 |
| 4 | 3 | 2,3 |
| 5 | 3 | 4,5 |
| 6 | 2 | 0,2 |
| 7-15 | Reserved | Reserved |

Table 7.3.1.1.2-18: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=1, rank =3

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-2 |
| 1 | 3 | 0-2 |
| 2 | 3 | 3-5 |
| 3-15 | Reserved | Reserved |

Table 7.3.1.1.2-19: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=1, rank =4

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-3 |
| 1 | 3 | 0-3 |
| 2-15 | Reserved | Reserved |

Table 7.3.1.1.2-20: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=2, rank=1

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 0 | 1 |
| 3 | 2 | 1 | 1 |
| 4 | 2 | 2 | 1 |
| 5 | 2 | 3 | 1 |
| 6 | 3 | 0 | 1 |
| 7 | 3 | 1 | 1 |
| 8 | 3 | 2 | 1 |
| 9 | 3 | 3 | 1 |
| 10 | 3 | 4 | 1 |
| 11 | 3 | 5 | 1 |
| 12 | 3 | 0 | 2 |
| 13 | 3 | 1 | 2 |
| 14 | 3 | 2 | 2 |
| 15 | 3 | 3 | 2 |
| 16 | 3 | 4 | 2 |
| 17 | 3 | 5 | 2 |
| 18 | 3 | 6 | 2 |
| 19 | 3 | 7 | 2 |
| 20 | 3 | 8 | 2 |
| 21 | 3 | 9 | 2 |
| 22 | 3 | 10 | 2 |
| 23 | 3 | 11 | 2 |
| 24 | 1 | 0 | 2 |
| 25 | 1 | 1 | 2 |
| 26 | 1 | 6 | 2 |
| 27 | 1 | 7 | 2 |
| 28-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-21: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=2, rank=2

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0,1 | 1 |
| 1 | 2 | 0,1 | 1 |
| 2 | 2 | 2,3 | 1 |
| 3 | 3 | 0,1 | 1 |
| 4 | 3 | 2,3 | 1 |
| 5 | 3 | 4,5 | 1 |
| 6 | 2 | 0,2 | 1 |
| 7 | 3 | 0,1 | 2 |
| 8 | 3 | 2,3 | 2 |
| 9 | 3 | 4,5 | 2 |
| 10 | 3 | 6,7 | 2 |
| 11 | 3 | 8,9 | 2 |
| 12 | 3 | 10,11 | 2 |
| 13 | 1 | 0,1 | 2 |
| 14 | 1 | 6,7 | 2 |
| 15 | 2 | 0,1 | 2 |
| 16 | 2 | 2,3 | 2 |
| 17 | 2 | 6,7 | 2 |
| 18 | 2 | 8,9 | 2 |
| 19-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-22: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=2, rank=3

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0-2 | 1 |
| 1 | 3 | 0-2 | 1 |
| 2 | 3 | 3-5 | 1 |
| 3 | 3 | 0,1,6 | 2 |
| 4 | 3 | 2,3,8 | 2 |
| 5 | 3 | 4,5,10 | 2 |
| 6-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-23: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *maxLength*=2, rank=4

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0-3 | 1 |
| 1 | 3 | 0-3 | 1 |
| 2 | 3 | 0,1,6,7 | 2 |
| 3 | 3 | 2,3,8,9 | 2 |
| 4 | 3 | 4,5,10,11 | 2 |
| 5-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-24: SRS request

|  |  |  |
| --- | --- | --- |
| Value of SRS request field | Triggered aperiodic SRS resource set(s) for DCI format 0\_1, 0\_2, 1\_1, 1\_2, and 2\_3 configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeB' | Triggered aperiodic SRS resource set(s) for DCI format 2\_3 configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeA' |
| 00 | No aperiodic SRS resource set triggered | No aperiodic SRS resource set triggered |
| 01 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 1 or an entry in *aperiodicSRS-ResourceTriggerList* set to 1  SRS resource set(s) configured by *SRS-PosResourceSet* with an entry in *aperiodicSRS-ResourceTriggerList* set to 1 when triggered by DCI formats 0\_1, 0\_2, 1\_1, and 1\_2 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 1st set of serving cells configured by higher layers |
| 10 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 2 or an entry in *aperiodicSRS-ResourceTriggerList* set to 2  SRS resource set(s) configured by *SRS-PosResourceSet* with an entry in *aperiodicSRS-ResourceTriggerList* set to 2 when triggered by DCI formats 0\_1, 0\_2, 1\_1, and 1\_2 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 2nd set of serving cells configured by higher layers |
| 11 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 3 or an entry in *aperiodicSRS-ResourceTriggerList* set to 3  SRS resource set(s) configured by *SRS-PosResourceSet* with an entry in *aperiodicSRS-ResourceTriggerList* set to 3 when triggered by DCI formats 0\_1, 0\_2, 1\_1, and 1\_2 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 3rd set of serving cells configured by higher layers |

Table 7.3.1.1.2-25: PTRS-DMRS association for UL PTRS port 0

|  |  |
| --- | --- |
| **Value** | **DMRS port** |
| 0 | 1st scheduled DMRS port |
| 1 | 2nd scheduled DMRS port |
| 2 | 3rd scheduled DMRS port |
| 3 | 4th scheduled DMRS port |

Table 7.3.1.1.2-26: PTRS-DMRS association for UL PTRS ports 0 and 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Value of MSB** | **DMRS port** |  | **Value of LSB** | **DMRS port** |
| 0 | 1st DMRS port which shares PTRS port 0 |  | 0 | 1st DMRS port which shares PTRS port 1 |
| 1 | 2nd DMRS port which shares PTRS port 0 |  | 1 | 2nd DMRS port which shares PTRS port 1 |

Table 7.3.1.1.2-27: void

Table 7.3.1.1.2-28: SRI indication for non-codebook based PUSCH transmission, 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
|  |  | 2 | 2 | 2 | 2 |
|  |  | 3 | reserved | 3 | 3 |

Table 7.3.1.1.2-29: SRI indication for non-codebook based PUSCH transmission, 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0,1 | 2 | 2 | 2 | 2 |
| 3 | reserved | 3 | 0,1 | 3 | 3 |
|  |  | 4 | 0,2 | 4 | 0,1 |
|  |  | 5 | 1,2 | 5 | 0,2 |
|  |  | 6-7 | reserved | 6 | 0,3 |
|  |  |  |  | 7 | 1,2 |
|  |  |  |  | 8 | 1,3 |
|  |  |  |  | 9 | 2,3 |
|  |  |  |  | 10-15 | reserved |

Table 7.3.1.1.2-29A: Second SRI indication for non-codebook based PUSCH transmission,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0,1 | 2 | 2 | 2 | 2 |
| 1 | 2 layers: reserved | 3 | 1 layer: reserved | 3 | 3 |
|  |  | 0 | 0,1 | 4-7 | 1 layer: reserved |
|  |  | 1 | 0,2 | 0 | 0,1 |
|  |  | 2 | 1,2 | 1 | 0,2 |
|  |  | 3 | 2 layers: reserved | 2 | 0,3 |
|  |  |  |  | 3 | 1,2 |
|  |  |  |  | 4 | 1,3 |
|  |  |  |  | 5 | 2,3 |
|  |  |  |  | 6-7 | 2 layers: reserved |

Table 7.3.1.1.2-30: SRI indication for non-codebook based PUSCH transmission, 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0,1 | 2 | 2 | 2 | 2 |
| 3 | reserved | 3 | 0,1 | 3 | 3 |
|  |  | 4 | 0,2 | 4 | 0,1 |
|  |  | 5 | 1,2 | 5 | 0,2 |
|  |  | 6 | 0,1,2 | 6 | 0,3 |
|  |  | 7 | reserved | 7 | 1,2 |
|  |  |  |  | 8 | 1,3 |
|  |  |  |  | 9 | 2,3 |
|  |  |  |  | 10 | 0,1,2 |
|  |  |  |  | 11 | 0,1,3 |
|  |  |  |  | 12 | 0,2,3 |
|  |  |  |  | 13 | 1,2,3 |
|  |  |  |  | 14-15 | reserved |

Table 7.3.1.1.2-30A: Second SRI indication for non-codebook based PUSCH transmission,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0,1 | 2 | 2 | 2 | 2 |
| 1 | 2 layers: reserved | 3 | 1 layer: reserved | 3 | 3 |
|  |  | 0 | 0,1 | 4-7 | 1 layer: reserved |
|  |  | 1 | 0,2 | 0 | 0,1 |
|  |  | 2 | 1,2 | 1 | 0,2 |
|  |  | 3 | 2 layers: reserved | 2 | 0,3 |
|  |  | 0 | 0,1,2 | 3 | 1,2 |
|  |  | 1-3 | 3 layers: reserved | 4 | 1,3 |
|  |  |  |  | 5 | 2,3 |
|  |  |  |  | 6-7 | 2 layers: reserved |
|  |  |  |  | 0 | 0,1,2 |
|  |  |  |  | 1 | 0,1,3 |
|  |  |  |  | 2 | 0,2,3 |
|  |  |  |  | 3 | 1,2,3 |
|  |  |  |  | 4-7 | 3 layers: reserved |

Table 7.3.1.1.2-31: SRI indication for non-codebook based PUSCH transmission, 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0,1 | 2 | 2 | 2 | 2 |
| 3 | reserved | 3 | 0,1 | 3 | 3 |
|  |  | 4 | 0,2 | 4 | 0,1 |
|  |  | 5 | 1,2 | 5 | 0,2 |
|  |  | 6 | 0,1,2 | 6 | 0,3 |
|  |  | 7 | reserved | 7 | 1,2 |
|  |  |  |  | 8 | 1,3 |
|  |  |  |  | 9 | 2,3 |
|  |  |  |  | 10 | 0,1,2 |
|  |  |  |  | 11 | 0,1,3 |
|  |  |  |  | 12 | 0,2,3 |
|  |  |  |  | 13 | 1,2,3 |
|  |  |  |  | 14 | 0,1,2,3 |
|  |  |  |  | 15 | reserved |

Table 7.3.1.1.2-31A: Second SRI indication for non-codebook based PUSCH transmission,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0,1 | 2 | 2 | 2 | 2 |
| 1 | 2 layers: reserved | 3 | 1 layer: reserved | 3 | 3 |
|  |  | 0 | 0,1 | 4-7 | 1 layer: reserved |
|  |  | 1 | 0,2 | 0 | 0,1 |
|  |  | 2 | 1,2 | 1 | 0,2 |
|  |  | 3 | 2 layers: reserved | 2 | 0,3 |
|  |  | 0 | 0,1,2 | 3 | 1,2 |
|  |  | 1-3 | 3 layers: reserved | 4 | 1,3 |
|  |  |  |  | 5 | 2,3 |
|  |  |  |  | 6-7 | 2 layers: reserved |
|  |  |  |  | 0 | 0,1,2 |
|  |  |  |  | 1 | 0,1,3 |
|  |  |  |  | 2 | 0,2,3 |
|  |  |  |  | 3 | 1,2,3 |
|  |  |  |  | 4-7 | 3 layer: reserved |
|  |  |  |  | 0 | 0,1,2,3 |
|  |  |  |  | 1-7 | 4 layers: reserved |

Table 7.3.1.1.2-32: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission* is not configured, or *ul-FullPowerTransmission = fullpowerMode1, or ul-FullPowerTransmission = fullpowerMode2, or ul-FullPowerTransmission = fullpower* and

|  |  |
| --- | --- |
| Bit field mapped to index | SRI(s), |
| 0 | 0 |
| 1 | 1 |

Table 7.3.1.1.2-32A: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission = fullpowerMode2* and

|  |  |
| --- | --- |
| Bit field mapped to index | SRI(s), |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | Reserved |

Table 7.3.1.1.2-32B: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission = fullpowerMode2* and

|  |  |
| --- | --- |
| Bit field mapped to index | SRI(s), |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |

Table 7.3.1.1.2-33: Joint indication of minimum applicable scheduling offset K0/K2

|  |  |  |
| --- | --- | --- |
| **Bit field mapped to index** | **Minimum applicable K0 for the active DL BWP, if *minimumSchedulingOffsetK0* is configured for the DL BWP** | **Minimum applicable K2 for the active UL BWP, if *minimumSchedulingOffsetK2* is configured for the UL BWP** |
| 0 | The first value configured by *minimumSchedulingOffsetK0* for the active DL BWP | The first value configured by *minimumSchedulingOffsetK2* for the active UL BWP |
| 1 | The second value configured by *minimumSchedulingOffsetK0* for the active DL BWP if the second value is configured; 0 otherwise | The second value configured by *minimumSchedulingOffsetK2* for the active UL BWP if the second value is configured; 0 otherwise |

Table 7.3.1.1.2-34: Redundancy version

|  |  |
| --- | --- |
| **Value of the Redundancy version field** | **Value of  to be applied** |
| 0 | 0 |
| 1 | 2 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |

Table 7.3.1.1.2-36: SRS resource set indication

|  |  |
| --- | --- |
| Bit field mapped to index | SRS resource set indication |
| 0 | SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;  Second SRS resource indicator field and Second Precoding information field are reserved. |
| 1 | SRS resource indicator field and Precoding information and number of layers field are associated with the second SRS resource set;  Second SRS resource indicator field and Second Precoding information field are reserved. |
| 2 | SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;  Second SRS resource indicator field and Second Precoding information field are associated with the second SRS resource set. |
| 3 | SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;  Second SRS resource indicator field and Second Precoding information field are associated with the second SRS resource set. |
| NOTE 1: The first and the second SRS resource sets are respectively the ones with lower and higher *srs-ResourceSetId* of the two SRS resources sets configured by higher layer parameter *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, and associated with the higher layer parameter *usage* of value '*nonCodeBook*' if *txConfig*=*nonCodebook* or '*codeBook*' if *txConfig*=*codebook*.  NOTE 2: For DCI format 0\_2, the first and second SRS resource sets configured by higher layer parameter *srs-ResourceSetToAddModListDCI-0-2* are composed of the first SRS resources together with other configurations in the first and second SRS resource 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’.* | |

##### 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].

- 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.

- HARQ process number – 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 or 4 bits otherwise,

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

- 1 bit for semi-static HARQ-ACK codebook;

- 2 bits for dynamic HARQ-ACK codebook.

- 2nd downlink assignment index – 0 or 2 bits

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

- 0 bit otherwise.

When two HARQ-ACK codebooks are configured for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-2* is configured, if the bit width of the Downlink assignment index in DCI format 0\_2 for one HARQ-ACK codebook is not equal to that of the 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 Downlink assignment index until the bit width of the 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 = codebook*, 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 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 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 SRS resource set indicated by SRS resource set indicator field*,* 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 SRS resource set indicated by SRS resource set indicator field.

- 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.

- 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*;

- 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*;

- 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 7.3.1.1.2-4 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.

- 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.

- 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;

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

- 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 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. When the SRS resource set indicator field is present and *maxRankDCI-0-2=2*, the MSB indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers, and the LSB indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator and/or Second Precoding information.

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.

- Second PTRS-DMRS association – 2 bits if PTRS-DMRS association field and SRS resource set indicator field are present and *m 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 *betaOffsets = semiStatic*; 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 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.

- 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).

- 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].

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.

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 |

< Unchanged parts are omitted >

##### 7.3.1.2.2 Format 1\_1

< Unchanged parts are omitted >

- TPC command for scheduled PUCCH – 2 bits as defined in Clause 7.2.1 of [5, TS 38.213]

- Second TPC command for scheduled PUCCH – 2 bits as defined in Clause 7.2.1 of [5, TS 38.213] if higher layer parameter *SecondTPCFieldDCI-1-1* is configured; 0 bit otherwise.

- PUCCH resource indicator – 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]

- 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, 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.

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

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

- 0 bit otherwise.

- 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.

- Antenna port(s) – 4, 5, or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4 and Tables 7.3.1.2.2-1A/2A/3A/4A, 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 or Tables 7.3.1.2.2-1A/2A/3A/4A. When a UE receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4. The UE can receive an entry with DMRS ports equals to 1000, 1002, 1003 when two TCI states are indicated in a codepoint of DCI field '*Transmission Configuration Indication*'.

If a UE is configured with both *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB*, the bitwidth of this field equals , where  is the "Antenna ports" bitwidth derived according to *dmrs-DownlinkForPDSCH-MappingTypeA* and  is the "Antenna ports" bitwidthderived according to *dmrs-DownlinkForPDSCH-MappingTypeB*. 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 .

- Transmission configuration indication – 0 bit if higher layer parameter *tci-PresentInDCI* is not enabled; otherwise 3 bits as defined in Clause 5.1.5 of [6, TS38.214].

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part,

- if the higher layer parameter *tci-PresentInDCI* is not enabled for the CORESET used for the PDCCH carrying the DCI format 1\_1,

- the UE assumes *tci-PresentInDCI* is not enabled for all CORESETs in the indicated bandwidth part;

- otherwise,

- the UE assumes *tci-PresentInDCI* is enabled for all CORESETs in the indicated bandwidth part.

- 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;

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

- CBG transmission information (CBGTI) – 0 bit if higher layer parameter *codeBlockGroupTransmission* for PDSCH is not configured, otherwise, 2, 4, 6, or 8 bits as defined in Clause 5.1.7 of [6, TS38.214], determined by the higher layer parameters *maxCodeBlockGroupsPerTransportBlock* and *maxNrofCodeWordsScheduledByDCI* for the PDSCH.

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

- CBG flushing out information (CBGFI) – 1 bit if higher layer parameter *codeBlockGroupFlushIndicator* is configured as "TRUE", 0 bit otherwise.

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

- DMRS sequence initialization – 1 bit.

- Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-1-1* 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-1-1* 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; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1.*

- Minimum applicable scheduling offset indicator – 0 or 1 bit

- 0 bit if higher layer parameter *minimumSchedulingOffsetK0* is not configured;

- 1 bit if higher layer parameter *minimumSchedulingOffsetK0* is configured. The 1 bit indication is used to determine the minimum applicable K0 for the active DL BWP and the minimum applicable K2 value for the active UL 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 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

< Unchanged parts are omitted >

##### 7.3.1.2.3 Format 1\_2

< Unchanged parts are omitted >

- TPC command for scheduled PUCCH – 2 bits as defined in Clause 7.2.1 of [5, TS 38.213]

- Second TPC command for scheduled PUCCH – 2 bits as defined in Clause 7.2.1 of [5, TS 38.213] if higher layer parameter *SecondTPCFieldDCI-1-2* is configured; 0 bit otherwise.

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

- 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, 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.

- 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.

- Transmission configuration indication – 0 bit if higher layer parameter *tci-PresentDCI-1-2* is not configured; otherwise 1 or 2 or 3 bits determined by higher layer parameter *tci-PresentDCI-1-2* as defined in Clause 5.1.5 of [6, TS38.214].

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part,

- if the higher layer parameter *tci-PresentDCI-1-2* is not configured for the CORESET used for the PDCCH carrying the DCI format 1\_2,

- the UE assumes *tci-PresentDCI-1-2* is not configured for all CORESETs in the indicated bandwidth part;

- otherwise,

- the UE assumes *tci-PresentDCI-1-2* is configured for all CORESETs in the indicated bandwidth part with the same value configured for the CORESET used for the PDCCH carrying the DCI format 1\_2.

- SRS request – 0, 1, 2 or 3 bits

- 0 bit if the higher layer parameter *srs-RequestDCI-1-2* is not configured;

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

- 2 bits if the higher layer parameter *srs-RequestDCI-1-2 = 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 the higher layer parameter *srs-RequestDCI-1-2 = 2* and for UEs not configured with *supplementaryUplink* in *ServingCellConfig* in the cell;

- 3 bits if the higher layer parameter *srs-RequestDCI-1-2 = 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;

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

- DMRS sequence initialization – 0 or 1 bit

- 0 bit if the higher layer parameter *dmrs-SequenceInitializationDCI-1-2* is not configured;

- 1 bit otherwise.

- 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].

< Unchanged parts are omitted >