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| Technical Specification | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Network;  NR;  Multiplexing and channel coding  (Release 18) | |
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# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document specifies the coding, multiplexing and mapping to physical channels for 5G NR.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] void.

[3] void.

[4] 3GPP TS 38.211: "NR; Physical channels and modulation".

[5] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[6] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[7] void.

[8] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[9] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[10] 3GPP TS 38.473: "NG-RAN; F1 Application Protocol (F1AP)".

[11] 3GPP TS 36.212: "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding".

[12] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle‑to‑Everything (V2X) services".

[13] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[14] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

BCH Broadcast Channel

CAPC Channel Access Priority Class

CBG Code Block Group

CBGTI Code Block Group Transmission Information

CG Configured Grant

CG-DFI CG - Downlink Feedback Information

CG-UCI CG - Uplink Control Information

CORESET Control Resource Ret

COT Channel Occupancy Time

CQI Channel Quality Indicator

CRC Cyclic Redundancy Check

CRI CSI-RS Resource Indicator

CSI Channel State Information

CSI-RS CSI - Reference Signal

DAI Downlink Assignment Index

DCI Downlink Control Information

DL Downlink

DL-SCH Downlink - Shared Channel

DMRS Demodulation Reference Signal

HARQ Hybrid Automatic repeat Request

HARQ-ACK Hybrid Automatic repeat Request - Acknowledgement

LDPC Low Density Parity Check

LI Layer Indicator

MBS Multicast Broadcast Services

MCS Modulation and Coding Scheme

NCR Network-controlled repeater

OFDM Orthogonal Frequency Division Multiplex

PBCH Physical Broadcast Channel

PCH Paging Channel

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PMI Precoding Matrix Indicator

PRB Physical Resource Block

PRACH Physical Random Access Channel

PSBCH Physical Sidelink Broadcast Channel

PSCCH Physical Sidelink Control Channel

PSFCH Physical Sidelink Feedback Channel

PSSCH Physical Sidelink Shared Channel

PTRS Phase-Tracking Reference Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

RACH Random Access Channel

RI Rank Indicator

RSRP Reference Signal Received Power

SCI Sidelink Control Information

SFCI Sidelink Feedback Control Information

SFN System Frame Number

SL Sidelink

SL-BCH Sidelink - Broadcast Channel

SL PRS Sidelink Positioning Reference Signal

SL-SCH Sidelink - Shared Channel

SR Scheduling Request

SRS Sounding Reference Signal

SS Synchronisation Signal

SUL Supplementary Uplink

TCI Transmission Configuration Indicator

TPC Transmit Power Control

TrCH Transport Channel

UCI Uplink Control Information

UE User Equipment

UL Uplink

UL-SCH Uplink Shared Channel

UTO-UCI Unused Transmission Occasion - Uplink Control Information

VRB Virtual Resource Block

ZP CSI-RS Zero power CSI-RS

# 4 Mapping to physical channels

## 4.1 Uplink

Table 4.1-1 specifies the mapping of the uplink transport channels to their corresponding physical channels. Table 4.1-2 specifies the mapping of the uplink control channel information to its corresponding physical channel.

Table 4.1-1

|  |  |
| --- | --- |
| **TrCH** | **Physical Channel** |
| UL-SCH | PUSCH |
| RACH | PRACH |

Table 4.1-2

|  |  |
| --- | --- |
| **Control information** | **Physical Channel** |
| UCI | PUCCH, PUSCH |

## 4.2 Downlink

Table 4.2-1 specifies the mapping of the downlink transport channels to their corresponding physical channels. Table 4.2-2 specifies the mapping of the downlink control channel information to its corresponding physical channel.

Table 4.2-1

|  |  |
| --- | --- |
| **TrCH** | **Physical Channel** |
| DL-SCH | PDSCH |
| BCH | PBCH |
| PCH | PDSCH |

Table 4.2-2

|  |  |
| --- | --- |
| **Control information** | **Physical Channel** |
| DCI | PDCCH |

## 4.3 Sidelink

Table 4.3-1 specifies the mapping of the sidelink transport channels to their corresponding physical channels. Table 4.3-2 specifies the mapping of the sidelink control information and sidelink feedback control information to their corresponding physical channels.

Table 4.3-1

|  |  |
| --- | --- |
| **TrCH** | **Physical Channel** |
| SL-SCH | PSSCH |
| SL-BCH | PSBCH |

Table 4.3-2

|  |  |
| --- | --- |
| **Control information** | **Physical Channel** |
| 1st-stage SCI | PSCCH |
| 2nd-stage SCI | PSSCH |
| SFCI | PSFCH |

# 5 General procedures

Data and control streams from/to MAC layer are encoded /decoded to offer transport and control services over the radio transmission link. Channel coding scheme is a combination of error detection, error correcting, rate matching, interleaving and transport channel or control information mapping onto/splitting from physical channels.

## 5.1 CRC calculation

Denote the input bits to the CRC computation by , and the parity bits by , where  is the size of the input sequence and  is the number of parity bits. The parity bits are generated by one of the following cyclic generator polynomials:

-  for a CRC length ;

-  for a CRC length ;

-  for a CRC length ;

-  for a CRC length ;

-  for a CRC length ;

-  for a CRC length .

The encoding is performed in a systematic form, which means that in GF(2), the polynomial:



yields a remainder equal to 0 when divided by the corresponding CRC generator polynomial.

The bits after CRC attachment are denoted by , where . The relation between  and  is:

 for 

 for .

## 5.2 Code block segmentation and code block CRC attachment

### 5.2.1 Polar coding

The input bit sequence to the code block segmentation is denoted by , where .

if 

Number of code blocks: ;

else

Number of code blocks: 

end if

;

for  to 

;

end for

for  to 

;

end for

;

for  to 

for  to 

;

;

end for

The sequence  is used to calculate the CRC parity bits  according to Clause 5.1 with a generator polynomial of length .

for  to 

;

end for

end for

The value of  is no larger than 1706.

### 5.2.2 Low density parity check coding

The input bit sequence to the code block segmentation is denoted by , where . If  is larger than the maximum code block size , segmentation of the input bit sequence is performed and an additional CRC sequence of  bits is attached to each code block.

For LDPC base graph 1, the maximum code block size is:

- .

For LDPC base graph 2, the maximum code block size is:

- .

Total number of code blocks *C* is determined by:

if 



Number of code blocks: 



else



Number of code blocks: .



end if

The bits output from code block segmentation are denoted by , where  is the code block number, and  is the number of bits for the code block number .

The number of bits  in each code block is calculated as:

;

For LDPC base graph 1,

.

For LDPC base graph 2,

if 

;

elseif 

;

elseif 

;

else

;

end if

find the minimum value of  in all sets of lifting sizes in Table 5.3.2-1, denoted as , such that , and set  for LDPC base graph 1 and  for LDPC base graph 2;

The bit sequence  is calculated as:

;

for  to 

for  to 

;

;

end for

if 

The sequence  is used to calculate the CRC parity bits  according to Clause 5.1 with the generator polynomial .

for  to 

;

end for

end if

for  to  -- Insertion of filler bits

;

end for

end for

## 5.3 Channel coding

Usage of coding scheme for the different types of TrCH is shown in table 5.3-1. Usage of coding scheme for the different control information types is shown in table 5.3-2.

Table 5.3-1: Usage of channel coding scheme for TrCHs

|  |  |
| --- | --- |
| TrCH | Coding scheme |
| UL-SCH | LDPC |
| DL-SCH |
| PCH |
| BCH | Polar code |

Table 5.3-2: Usage of channel coding scheme for control information

|  |  |
| --- | --- |
| Control Information | Coding scheme |
| DCI | Polar code |
| UCI | Block code |
| Polar code |

### 5.3.1 Polar coding

The bit sequence input for a given code block to channel coding is denoted by, where  is the number of bits to encode. After encoding the bits are denoted by, where  and the value of  is determined by the following:

Denote by  the rate matching output sequence length as given in Clause 5.4.1;

If  and 

;

else

;

end if

;

;



where .

UE is not expected to be configured with , where  is the number of parity check bits defined in Clause 5.3.1.2.

#### 5.3.1.1 Interleaving

The bit sequence  is interleaved into bit sequence  as follows:

, 

where the interleaving pattern  is given by the following:

if 

, 

else

;

for  to 

if 

;

;

end if

end for

end if

where  is given by Table 5.3.1.1-1 and .

Table 5.3.1.1-1: Interleaving pattern 

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 28 | 67 | 56 | 122 | 84 | 68 | 112 | 33 | 140 | 38 |
| 1 | 2 | 29 | 69 | 57 | 123 | 85 | 73 | 113 | 36 | 141 | 144 |
| 2 | 4 | 30 | 70 | 58 | 126 | 86 | 78 | 114 | 44 | 142 | 39 |
| 3 | 7 | 31 | 71 | 59 | 127 | 87 | 84 | 115 | 47 | 143 | 145 |
| 4 | 9 | 32 | 72 | 60 | 129 | 88 | 90 | 116 | 64 | 144 | 40 |
| 5 | 14 | 33 | 76 | 61 | 132 | 89 | 92 | 117 | 74 | 145 | 146 |
| 6 | 19 | 34 | 77 | 62 | 134 | 90 | 94 | 118 | 79 | 146 | 41 |
| 7 | 20 | 35 | 81 | 63 | 138 | 91 | 96 | 119 | 85 | 147 | 147 |
| 8 | 24 | 36 | 82 | 64 | 139 | 92 | 99 | 120 | 97 | 148 | 148 |
| 9 | 25 | 37 | 83 | 65 | 140 | 93 | 102 | 121 | 100 | 149 | 149 |
| 10 | 26 | 38 | 87 | 66 | 1 | 94 | 105 | 122 | 103 | 150 | 150 |
| 11 | 28 | 39 | 88 | 67 | 3 | 95 | 107 | 123 | 117 | 151 | 151 |
| 12 | 31 | 40 | 89 | 68 | 5 | 96 | 109 | 124 | 125 | 152 | 152 |
| 13 | 34 | 41 | 91 | 69 | 8 | 97 | 112 | 125 | 131 | 153 | 153 |
| 14 | 42 | 42 | 93 | 70 | 10 | 98 | 114 | 126 | 136 | 154 | 154 |
| 15 | 45 | 43 | 95 | 71 | 15 | 99 | 116 | 127 | 142 | 155 | 155 |
| 16 | 49 | 44 | 98 | 72 | 21 | 100 | 121 | 128 | 12 | 156 | 156 |
| 17 | 50 | 45 | 101 | 73 | 27 | 101 | 124 | 129 | 17 | 157 | 157 |
| 18 | 51 | 46 | 104 | 74 | 29 | 102 | 128 | 130 | 23 | 158 | 158 |
| 19 | 53 | 47 | 106 | 75 | 32 | 103 | 130 | 131 | 37 | 159 | 159 |
| 20 | 54 | 48 | 108 | 76 | 35 | 104 | 133 | 132 | 48 | 160 | 160 |
| 21 | 56 | 49 | 110 | 77 | 43 | 105 | 135 | 133 | 75 | 161 | 161 |
| 22 | 58 | 50 | 111 | 78 | 46 | 106 | 141 | 134 | 80 | 162 | 162 |
| 23 | 59 | 51 | 113 | 79 | 52 | 107 | 6 | 135 | 86 | 163 | 163 |
| 24 | 61 | 52 | 115 | 80 | 55 | 108 | 11 | 136 | 137 |  |  |
| 25 | 62 | 53 | 118 | 81 | 57 | 109 | 16 | 137 | 143 |  |  |
| 26 | 65 | 54 | 119 | 82 | 60 | 110 | 22 | 138 | 13 |  |  |
| 27 | 66 | 55 | 120 | 83 | 63 | 111 | 30 | 139 | 18 |  |  |

#### 5.3.1.2 Polar encoding

The Polar sequence  is given by Table 5.3.1.2-1, where  denotes a bit index before Polar encoding for  and . The Polar sequence  is in ascending order of reliability , where  denotes the reliability of bit index .

For any code block encoded to  bits, a same Polar sequence  is used. The Polar sequence  is a subset of Polar sequence  with all elements  of values less than , ordered in ascending order of reliability .

Denote  as a set of bit indices in Polar sequence , and  as the set of other bit indices in Polar sequence , where  and  are given in Clause 5.4.1.1, , , and  is the number of parity check bits.

Denote  as the -th Kronecker power of matrix , where .

For a bit index  with , denote  as the -th row of  and  as the row weight of , where  is the number of ones in . Denote the set of bit indices for parity check bits as , where . A number of  parity check bits are placed in the  least reliable bit indices in . A number of  other parity check bits are placed in the bit indices of minimum row weight in , where  denotes the  most reliable bit indices in ; if there are more than  bit indices of the same minimum row weight in , the  other parity check bits are placed in the  bit indices of the highest reliability and the minimum row weight in .

Generate  according to the following:

;

if 

; ; ; ; ;

for  to 

; ; ; ; ; ;

if 

if 

;

else

;

;

;

end if

else

;

end if

end for

else

for  to 

if 

;

;

else

;

end if

end for

end if

The output after encoding  is obtained by . The encoding is performed in GF(2).

Table 5.3.1.2-1: Polar sequence  and its corresponding reliability 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 128 | 518 | 256 | 94 | 384 | 214 | 512 | 364 | 640 | 414 | 768 | 819 | 896 | 966 |
| 1 | 1 | 129 | 54 | 257 | 204 | 385 | 309 | 513 | 654 | 641 | 223 | 769 | 814 | 897 | 755 |
| 2 | 2 | 130 | 83 | 258 | 298 | 386 | 188 | 514 | 659 | 642 | 663 | 770 | 439 | 898 | 859 |
| 3 | 4 | 131 | 57 | 259 | 400 | 387 | 449 | 515 | 335 | 643 | 692 | 771 | 929 | 899 | 940 |
| 4 | 8 | 132 | 521 | 260 | 608 | 388 | 217 | 516 | 480 | 644 | 835 | 772 | 490 | 900 | 830 |
| 5 | 16 | 133 | 112 | 261 | 352 | 389 | 408 | 517 | 315 | 645 | 619 | 773 | 623 | 901 | 911 |
| 6 | 32 | 134 | 135 | 262 | 325 | 390 | 609 | 518 | 221 | 646 | 472 | 774 | 671 | 902 | 871 |
| 7 | 3 | 135 | 78 | 263 | 533 | 391 | 596 | 519 | 370 | 647 | 455 | 775 | 739 | 903 | 639 |
| 8 | 5 | 136 | 289 | 264 | 155 | 392 | 551 | 520 | 613 | 648 | 796 | 776 | 916 | 904 | 888 |
| 9 | 64 | 137 | 194 | 265 | 210 | 393 | 650 | 521 | 422 | 649 | 809 | 777 | 463 | 905 | 479 |
| 10 | 9 | 138 | 85 | 266 | 305 | 394 | 229 | 522 | 425 | 650 | 714 | 778 | 843 | 906 | 946 |
| 11 | 6 | 139 | 276 | 267 | 547 | 395 | 159 | 523 | 451 | 651 | 721 | 779 | 381 | 907 | 750 |
| 12 | 17 | 140 | 522 | 268 | 300 | 396 | 420 | 524 | 614 | 652 | 837 | 780 | 497 | 908 | 969 |
| 13 | 10 | 141 | 58 | 269 | 109 | 397 | 310 | 525 | 543 | 653 | 716 | 781 | 930 | 909 | 508 |
| 14 | 18 | 142 | 168 | 270 | 184 | 398 | 541 | 526 | 235 | 654 | 864 | 782 | 821 | 910 | 861 |
| 15 | 128 | 143 | 139 | 271 | 534 | 399 | 773 | 527 | 412 | 655 | 810 | 783 | 726 | 911 | 757 |
| 16 | 12 | 144 | 99 | 272 | 537 | 400 | 610 | 528 | 343 | 656 | 606 | 784 | 961 | 912 | 970 |
| 17 | 33 | 145 | 86 | 273 | 115 | 401 | 657 | 529 | 372 | 657 | 912 | 785 | 872 | 913 | 919 |
| 18 | 65 | 146 | 60 | 274 | 167 | 402 | 333 | 530 | 775 | 658 | 722 | 786 | 492 | 914 | 875 |
| 19 | 20 | 147 | 280 | 275 | 225 | 403 | 119 | 531 | 317 | 659 | 696 | 787 | 631 | 915 | 862 |
| 20 | 256 | 148 | 89 | 276 | 326 | 404 | 600 | 532 | 222 | 660 | 377 | 788 | 729 | 916 | 758 |
| 21 | 34 | 149 | 290 | 277 | 306 | 405 | 339 | 533 | 426 | 661 | 435 | 789 | 700 | 917 | 948 |
| 22 | 24 | 150 | 529 | 278 | 772 | 406 | 218 | 534 | 453 | 662 | 817 | 790 | 443 | 918 | 977 |
| 23 | 36 | 151 | 524 | 279 | 157 | 407 | 368 | 535 | 237 | 663 | 319 | 791 | 741 | 919 | 923 |
| 24 | 7 | 152 | 196 | 280 | 656 | 408 | 652 | 536 | 559 | 664 | 621 | 792 | 845 | 920 | 972 |
| 25 | 129 | 153 | 141 | 281 | 329 | 409 | 230 | 537 | 833 | 665 | 812 | 793 | 920 | 921 | 761 |
| 26 | 66 | 154 | 101 | 282 | 110 | 410 | 391 | 538 | 804 | 666 | 484 | 794 | 382 | 922 | 877 |
| 27 | 512 | 155 | 147 | 283 | 117 | 411 | 313 | 539 | 712 | 667 | 430 | 795 | 822 | 923 | 952 |
| 28 | 11 | 156 | 176 | 284 | 212 | 412 | 450 | 540 | 834 | 668 | 838 | 796 | 851 | 924 | 495 |
| 29 | 40 | 157 | 142 | 285 | 171 | 413 | 542 | 541 | 661 | 669 | 667 | 797 | 730 | 925 | 703 |
| 30 | 68 | 158 | 530 | 286 | 776 | 414 | 334 | 542 | 808 | 670 | 488 | 798 | 498 | 926 | 935 |
| 31 | 130 | 159 | 321 | 287 | 330 | 415 | 233 | 543 | 779 | 671 | 239 | 799 | 880 | 927 | 978 |
| 32 | 19 | 160 | 31 | 288 | 226 | 416 | 555 | 544 | 617 | 672 | 378 | 800 | 742 | 928 | 883 |
| 33 | 13 | 161 | 200 | 289 | 549 | 417 | 774 | 545 | 604 | 673 | 459 | 801 | 445 | 929 | 762 |
| 34 | 48 | 162 | 90 | 290 | 538 | 418 | 175 | 546 | 433 | 674 | 622 | 802 | 471 | 930 | 503 |
| 35 | 14 | 163 | 545 | 291 | 387 | 419 | 123 | 547 | 720 | 675 | 627 | 803 | 635 | 931 | 925 |
| 36 | 72 | 164 | 292 | 292 | 308 | 420 | 658 | 548 | 816 | 676 | 437 | 804 | 932 | 932 | 878 |
| 37 | 257 | 165 | 322 | 293 | 216 | 421 | 612 | 549 | 836 | 677 | 380 | 805 | 687 | 933 | 735 |
| 38 | 21 | 166 | 532 | 294 | 416 | 422 | 341 | 550 | 347 | 678 | 818 | 806 | 903 | 934 | 993 |
| 39 | 132 | 167 | 263 | 295 | 271 | 423 | 777 | 551 | 897 | 679 | 461 | 807 | 825 | 935 | 885 |
| 40 | 35 | 168 | 149 | 296 | 279 | 424 | 220 | 552 | 243 | 680 | 496 | 808 | 500 | 936 | 939 |
| 41 | 258 | 169 | 102 | 297 | 158 | 425 | 314 | 553 | 662 | 681 | 669 | 809 | 846 | 937 | 994 |
| 42 | 26 | 170 | 105 | 298 | 337 | 426 | 424 | 554 | 454 | 682 | 679 | 810 | 745 | 938 | 980 |
| 43 | 513 | 171 | 304 | 299 | 550 | 427 | 395 | 555 | 318 | 683 | 724 | 811 | 826 | 939 | 926 |
| 44 | 80 | 172 | 296 | 300 | 672 | 428 | 673 | 556 | 675 | 684 | 841 | 812 | 732 | 940 | 764 |
| 45 | 37 | 173 | 163 | 301 | 118 | 429 | 583 | 557 | 618 | 685 | 629 | 813 | 446 | 941 | 941 |
| 46 | 25 | 174 | 92 | 302 | 332 | 430 | 355 | 558 | 898 | 686 | 351 | 814 | 962 | 942 | 967 |
| 47 | 22 | 175 | 47 | 303 | 579 | 431 | 287 | 559 | 781 | 687 | 467 | 815 | 936 | 943 | 886 |
| 48 | 136 | 176 | 267 | 304 | 540 | 432 | 183 | 560 | 376 | 688 | 438 | 816 | 475 | 944 | 831 |
| 49 | 260 | 177 | 385 | 305 | 389 | 433 | 234 | 561 | 428 | 689 | 737 | 817 | 853 | 945 | 947 |
| 50 | 264 | 178 | 546 | 306 | 173 | 434 | 125 | 562 | 665 | 690 | 251 | 818 | 867 | 946 | 507 |
| 51 | 38 | 179 | 324 | 307 | 121 | 435 | 557 | 563 | 736 | 691 | 462 | 819 | 637 | 947 | 889 |
| 52 | 514 | 180 | 208 | 308 | 553 | 436 | 660 | 564 | 567 | 692 | 442 | 820 | 907 | 948 | 984 |
| 53 | 96 | 181 | 386 | 309 | 199 | 437 | 616 | 565 | 840 | 693 | 441 | 821 | 487 | 949 | 751 |
| 54 | 67 | 182 | 150 | 310 | 784 | 438 | 342 | 566 | 625 | 694 | 469 | 822 | 695 | 950 | 942 |
| 55 | 41 | 183 | 153 | 311 | 179 | 439 | 316 | 567 | 238 | 695 | 247 | 823 | 746 | 951 | 996 |
| 56 | 144 | 184 | 165 | 312 | 228 | 440 | 241 | 568 | 359 | 696 | 683 | 824 | 828 | 952 | 971 |
| 57 | 28 | 185 | 106 | 313 | 338 | 441 | 778 | 569 | 457 | 697 | 842 | 825 | 753 | 953 | 890 |
| 58 | 69 | 186 | 55 | 314 | 312 | 442 | 563 | 570 | 399 | 698 | 738 | 826 | 854 | 954 | 509 |
| 59 | 42 | 187 | 328 | 315 | 704 | 443 | 345 | 571 | 787 | 699 | 899 | 827 | 857 | 955 | 949 |
| 60 | 516 | 188 | 536 | 316 | 390 | 444 | 452 | 572 | 591 | 700 | 670 | 828 | 504 | 956 | 973 |
| 61 | 49 | 189 | 577 | 317 | 174 | 445 | 397 | 573 | 678 | 701 | 783 | 829 | 799 | 957 | 1000 |
| 62 | 74 | 190 | 548 | 318 | 554 | 446 | 403 | 574 | 434 | 702 | 849 | 830 | 255 | 958 | 892 |
| 63 | 272 | 191 | 113 | 319 | 581 | 447 | 207 | 575 | 677 | 703 | 820 | 831 | 964 | 959 | 950 |
| 64 | 160 | 192 | 154 | 320 | 393 | 448 | 674 | 576 | 349 | 704 | 728 | 832 | 909 | 960 | 863 |
| 65 | 520 | 193 | 79 | 321 | 283 | 449 | 558 | 577 | 245 | 705 | 928 | 833 | 719 | 961 | 759 |
| 66 | 288 | 194 | 269 | 322 | 122 | 450 | 785 | 578 | 458 | 706 | 791 | 834 | 477 | 962 | 1008 |
| 67 | 528 | 195 | 108 | 323 | 448 | 451 | 432 | 579 | 666 | 707 | 367 | 835 | 915 | 963 | 510 |
| 68 | 192 | 196 | 578 | 324 | 353 | 452 | 357 | 580 | 620 | 708 | 901 | 836 | 638 | 964 | 979 |
| 69 | 544 | 197 | 224 | 325 | 561 | 453 | 187 | 581 | 363 | 709 | 630 | 837 | 748 | 965 | 953 |
| 70 | 70 | 198 | 166 | 326 | 203 | 454 | 236 | 582 | 127 | 710 | 685 | 838 | 944 | 966 | 763 |
| 71 | 44 | 199 | 519 | 327 | 63 | 455 | 664 | 583 | 191 | 711 | 844 | 839 | 869 | 967 | 974 |
| 72 | 131 | 200 | 552 | 328 | 340 | 456 | 624 | 584 | 782 | 712 | 633 | 840 | 491 | 968 | 954 |
| 73 | 81 | 201 | 195 | 329 | 394 | 457 | 587 | 585 | 407 | 713 | 711 | 841 | 699 | 969 | 879 |
| 74 | 50 | 202 | 270 | 330 | 527 | 458 | 780 | 586 | 436 | 714 | 253 | 842 | 754 | 970 | 981 |
| 75 | 73 | 203 | 641 | 331 | 582 | 459 | 705 | 587 | 626 | 715 | 691 | 843 | 858 | 971 | 982 |
| 76 | 15 | 204 | 523 | 332 | 556 | 460 | 126 | 588 | 571 | 716 | 824 | 844 | 478 | 972 | 927 |
| 77 | 320 | 205 | 275 | 333 | 181 | 461 | 242 | 589 | 465 | 717 | 902 | 845 | 968 | 973 | 995 |
| 78 | 133 | 206 | 580 | 334 | 295 | 462 | 565 | 590 | 681 | 718 | 686 | 846 | 383 | 974 | 765 |
| 79 | 52 | 207 | 291 | 335 | 285 | 463 | 398 | 591 | 246 | 719 | 740 | 847 | 910 | 975 | 956 |
| 80 | 23 | 208 | 59 | 336 | 232 | 464 | 346 | 592 | 707 | 720 | 850 | 848 | 815 | 976 | 887 |
| 81 | 134 | 209 | 169 | 337 | 124 | 465 | 456 | 593 | 350 | 721 | 375 | 849 | 976 | 977 | 985 |
| 82 | 384 | 210 | 560 | 338 | 205 | 466 | 358 | 594 | 599 | 722 | 444 | 850 | 870 | 978 | 997 |
| 83 | 76 | 211 | 114 | 339 | 182 | 467 | 405 | 595 | 668 | 723 | 470 | 851 | 917 | 979 | 986 |
| 84 | 137 | 212 | 277 | 340 | 643 | 468 | 303 | 596 | 790 | 724 | 483 | 852 | 727 | 980 | 943 |
| 85 | 82 | 213 | 156 | 341 | 562 | 469 | 569 | 597 | 460 | 725 | 415 | 853 | 493 | 981 | 891 |
| 86 | 56 | 214 | 87 | 342 | 286 | 470 | 244 | 598 | 249 | 726 | 485 | 854 | 873 | 982 | 998 |
| 87 | 27 | 215 | 197 | 343 | 585 | 471 | 595 | 599 | 682 | 727 | 905 | 855 | 701 | 983 | 766 |
| 88 | 97 | 216 | 116 | 344 | 299 | 472 | 189 | 600 | 573 | 728 | 795 | 856 | 931 | 984 | 511 |
| 89 | 39 | 217 | 170 | 345 | 354 | 473 | 566 | 601 | 411 | 729 | 473 | 857 | 756 | 985 | 988 |
| 90 | 259 | 218 | 61 | 346 | 211 | 474 | 676 | 602 | 803 | 730 | 634 | 858 | 860 | 986 | 1001 |
| 91 | 84 | 219 | 531 | 347 | 401 | 475 | 361 | 603 | 789 | 731 | 744 | 859 | 499 | 987 | 951 |
| 92 | 138 | 220 | 525 | 348 | 185 | 476 | 706 | 604 | 709 | 732 | 852 | 860 | 731 | 988 | 1002 |
| 93 | 145 | 221 | 642 | 349 | 396 | 477 | 589 | 605 | 365 | 733 | 960 | 861 | 823 | 989 | 893 |
| 94 | 261 | 222 | 281 | 350 | 344 | 478 | 215 | 606 | 440 | 734 | 865 | 862 | 922 | 990 | 975 |
| 95 | 29 | 223 | 278 | 351 | 586 | 479 | 786 | 607 | 628 | 735 | 693 | 863 | 874 | 991 | 894 |
| 96 | 43 | 224 | 526 | 352 | 645 | 480 | 647 | 608 | 689 | 736 | 797 | 864 | 918 | 992 | 1009 |
| 97 | 98 | 225 | 177 | 353 | 593 | 481 | 348 | 609 | 374 | 737 | 906 | 865 | 502 | 993 | 955 |
| 98 | 515 | 226 | 293 | 354 | 535 | 482 | 419 | 610 | 423 | 738 | 715 | 866 | 933 | 994 | 1004 |
| 99 | 88 | 227 | 388 | 355 | 240 | 483 | 406 | 611 | 466 | 739 | 807 | 867 | 743 | 995 | 1010 |
| 100 | 140 | 228 | 91 | 356 | 206 | 484 | 464 | 612 | 793 | 740 | 474 | 868 | 760 | 996 | 957 |
| 101 | 30 | 229 | 584 | 357 | 95 | 485 | 680 | 613 | 250 | 741 | 636 | 869 | 881 | 997 | 983 |
| 102 | 146 | 230 | 769 | 358 | 327 | 486 | 801 | 614 | 371 | 742 | 694 | 870 | 494 | 998 | 958 |
| 103 | 71 | 231 | 198 | 359 | 564 | 487 | 362 | 615 | 481 | 743 | 254 | 871 | 702 | 999 | 987 |
| 104 | 262 | 232 | 172 | 360 | 800 | 488 | 590 | 616 | 574 | 744 | 717 | 872 | 921 | 1000 | 1012 |
| 105 | 265 | 233 | 120 | 361 | 402 | 489 | 409 | 617 | 413 | 745 | 575 | 873 | 501 | 1001 | 999 |
| 106 | 161 | 234 | 201 | 362 | 356 | 490 | 570 | 618 | 603 | 746 | 913 | 874 | 876 | 1002 | 1016 |
| 107 | 576 | 235 | 336 | 363 | 307 | 491 | 788 | 619 | 366 | 747 | 798 | 875 | 847 | 1003 | 767 |
| 108 | 45 | 236 | 62 | 364 | 301 | 492 | 597 | 620 | 468 | 748 | 811 | 876 | 992 | 1004 | 989 |
| 109 | 100 | 237 | 282 | 365 | 417 | 493 | 572 | 621 | 655 | 749 | 379 | 877 | 447 | 1005 | 1003 |
| 110 | 640 | 238 | 143 | 366 | 213 | 494 | 219 | 622 | 900 | 750 | 697 | 878 | 733 | 1006 | 990 |
| 111 | 51 | 239 | 103 | 367 | 568 | 495 | 311 | 623 | 805 | 751 | 431 | 879 | 827 | 1007 | 1005 |
| 112 | 148 | 240 | 178 | 368 | 832 | 496 | 708 | 624 | 615 | 752 | 607 | 880 | 934 | 1008 | 959 |
| 113 | 46 | 241 | 294 | 369 | 588 | 497 | 598 | 625 | 684 | 753 | 489 | 881 | 882 | 1009 | 1011 |
| 114 | 75 | 242 | 93 | 370 | 186 | 498 | 601 | 626 | 710 | 754 | 866 | 882 | 937 | 1010 | 1013 |
| 115 | 266 | 243 | 644 | 371 | 646 | 499 | 651 | 627 | 429 | 755 | 723 | 883 | 963 | 1011 | 895 |
| 116 | 273 | 244 | 202 | 372 | 404 | 500 | 421 | 628 | 794 | 756 | 486 | 884 | 747 | 1012 | 1006 |
| 117 | 517 | 245 | 592 | 373 | 227 | 501 | 792 | 629 | 252 | 757 | 908 | 885 | 505 | 1013 | 1014 |
| 118 | 104 | 246 | 323 | 374 | 896 | 502 | 802 | 630 | 373 | 758 | 718 | 886 | 855 | 1014 | 1017 |
| 119 | 162 | 247 | 392 | 375 | 594 | 503 | 611 | 631 | 605 | 759 | 813 | 887 | 924 | 1015 | 1018 |
| 120 | 53 | 248 | 297 | 376 | 418 | 504 | 602 | 632 | 848 | 760 | 476 | 888 | 734 | 1016 | 991 |
| 121 | 193 | 249 | 770 | 377 | 302 | 505 | 410 | 633 | 690 | 761 | 856 | 889 | 829 | 1017 | 1020 |
| 122 | 152 | 250 | 107 | 378 | 649 | 506 | 231 | 634 | 713 | 762 | 839 | 890 | 965 | 1018 | 1007 |
| 123 | 77 | 251 | 180 | 379 | 771 | 507 | 688 | 635 | 632 | 763 | 725 | 891 | 938 | 1019 | 1015 |
| 124 | 164 | 252 | 151 | 380 | 360 | 508 | 653 | 636 | 482 | 764 | 698 | 892 | 884 | 1020 | 1019 |
| 125 | 768 | 253 | 209 | 381 | 539 | 509 | 248 | 637 | 806 | 765 | 914 | 893 | 506 | 1021 | 1021 |
| 126 | 268 | 254 | 284 | 382 | 111 | 510 | 369 | 638 | 427 | 766 | 752 | 894 | 749 | 1022 | 1022 |
| 127 | 274 | 255 | 648 | 383 | 331 | 511 | 190 | 639 | 904 | 767 | 868 | 895 | 945 | 1023 | 1023 |

### 5.3.2 Low density parity check coding

The bit sequence input for a given code block to channel coding is denoted by , where  is the number of bits to encode as defined in Clause 5.2.2. After encoding the bits are denoted by , where  for LDPC base graph 1 and  for LDPC base graph 2, and the value of  is given in Clause 5.2.2.

For a code block encoded by LDPC, the following encoding procedure applies:

1) Find the set with index  in Table 5.3.2-1 which contains .

2) for  to 

if 

;

else

;

;

end if

end for

3) Generate  parity bits  such that , where ;  is a column vector of all elements equal to 0. The encoding is performed in GF(2).

For LDPC base graph 1, a matrix of  has 46 rows with row indices and 68 columns with column indices . For LDPC base graph 2, a matrix of  has 42 rows with row indices and 52 columns with column indices . The elements in  with row and column indices given in Table 5.3.2-2 (for LDPC base graph 1) and Table 5.3.2-3 (for LDPC base graph 2) are of value 1, and all other elements in  are of value 0.

The matrix  is obtained by replacing each element of  with a  matrix, according to the following:

- Each element of value 0 in  is replaced by an all zero matrix of size ;

- Each element of value 1 in  is replaced by a circular permutation matrix  of size , where  and  are the row and column indices of the element, and  is obtained by circularly shifting the identity matrix of size  to the right  times. The value of  is given by . The value of  is given by Tables 5.3.2-2 and 5.3.2-3 according to the set index  and LDPC base graph.

4) for  to 

;

end for

Table 5.3.2-1: Sets of LDPC lifting size 

|  |  |
| --- | --- |
| *Set index (**)* | *Set of lifting sizes (**)* |
| 0 | {2, 4, 8, 16, 32, 64, 128, 256} |
| 1 | {3, 6, 12, 24, 48, 96, 192, 384} |
| 2 | {5, 10, 20, 40, 80, 160, 320} |
| 3 | {7, 14, 28, 56, 112, 224} |
| 4 | {9, 18, 36, 72, 144, 288} |
| 5 | {11, 22, 44, 88, 176, 352} |
| 6 | {13, 26, 52, 104, 208} |
| 7 | {15, 30, 60, 120, 240} |

Table 5.3.2-2: LDPC base graph 1 () and its parity check matrices ()

|  | |  | | | | | | | |  | |  | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Row  index | Column  index | Set index | | | | | | | | Row  index | Column  index | Set index | | | | | | | |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 0 | 0 | 250 | 307 | 73 | 223 | 211 | 294 | 0 | 135 | 15 | 1 | 96 | 2 | 290 | 120 | 0 | 348 | 6 | 138 |
| 1 | 69 | 19 | 15 | 16 | 198 | 118 | 0 | 227 | 10 | 65 | 210 | 60 | 131 | 183 | 15 | 81 | 220 |
| 2 | 226 | 50 | 103 | 94 | 188 | 167 | 0 | 126 | 13 | 63 | 318 | 130 | 209 | 108 | 81 | 182 | 173 |
| 3 | 159 | 369 | 49 | 91 | 186 | 330 | 0 | 134 | 18 | 75 | 55 | 184 | 209 | 68 | 176 | 53 | 142 |
| 5 | 100 | 181 | 240 | 74 | 219 | 207 | 0 | 84 | 25 | 179 | 269 | 51 | 81 | 64 | 113 | 46 | 49 |
| 6 | 10 | 216 | 39 | 10 | 4 | 165 | 0 | 83 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 59 | 317 | 15 | 0 | 29 | 243 | 0 | 53 | 16 | 1 | 64 | 13 | 69 | 154 | 270 | 190 | 88 | 78 |
| 10 | 229 | 288 | 162 | 205 | 144 | 250 | 0 | 225 | 3 | 49 | 338 | 140 | 164 | 13 | 293 | 198 | 152 |
| 11 | 110 | 109 | 215 | 216 | 116 | 1 | 0 | 205 | 11 | 49 | 57 | 45 | 43 | 99 | 332 | 160 | 84 |
| 12 | 191 | 17 | 164 | 21 | 216 | 339 | 0 | 128 | 20 | 51 | 289 | 115 | 189 | 54 | 331 | 122 | 5 |
| 13 | 9 | 357 | 133 | 215 | 115 | 201 | 0 | 75 | 22 | 154 | 57 | 300 | 101 | 0 | 114 | 182 | 205 |
| 15 | 195 | 215 | 298 | 14 | 233 | 53 | 0 | 135 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 23 | 106 | 110 | 70 | 144 | 347 | 0 | 217 | 17 | 0 | 7 | 260 | 257 | 56 | 153 | 110 | 91 | 183 |
| 18 | 190 | 242 | 113 | 141 | 95 | 304 | 0 | 220 | 14 | 164 | 303 | 147 | 110 | 137 | 228 | 184 | 112 |
| 19 | 35 | 180 | 16 | 198 | 216 | 167 | 0 | 90 | 16 | 59 | 81 | 128 | 200 | 0 | 247 | 30 | 106 |
| 20 | 239 | 330 | 189 | 104 | 73 | 47 | 0 | 105 | 17 | 1 | 358 | 51 | 63 | 0 | 116 | 3 | 219 |
| 21 | 31 | 346 | 32 | 81 | 261 | 188 | 0 | 137 | 21 | 144 | 375 | 228 | 4 | 162 | 190 | 155 | 129 |
| 22 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 1 | 42 | 130 | 260 | 199 | 161 | 47 | 1 | 183 |
| 1 | 0 | 2 | 76 | 303 | 141 | 179 | 77 | 22 | 96 | 12 | 233 | 163 | 294 | 110 | 151 | 286 | 41 | 215 |
| 2 | 239 | 76 | 294 | 45 | 162 | 225 | 11 | 236 | 13 | 8 | 280 | 291 | 200 | 0 | 246 | 167 | 180 |
| 3 | 117 | 73 | 27 | 151 | 223 | 96 | 124 | 136 | 18 | 155 | 132 | 141 | 143 | 241 | 181 | 68 | 143 |
| 4 | 124 | 288 | 261 | 46 | 256 | 338 | 0 | 221 | 19 | 147 | 4 | 295 | 186 | 144 | 73 | 148 | 14 |
| 5 | 71 | 144 | 161 | 119 | 160 | 268 | 10 | 128 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 222 | 331 | 133 | 157 | 76 | 112 | 0 | 92 | 19 | 0 | 60 | 145 | 64 | 8 | 0 | 87 | 12 | 179 |
| 8 | 104 | 331 | 4 | 133 | 202 | 302 | 0 | 172 | 1 | 73 | 213 | 181 | 6 | 0 | 110 | 6 | 108 |
| 9 | 173 | 178 | 80 | 87 | 117 | 50 | 2 | 56 | 7 | 72 | 344 | 101 | 103 | 118 | 147 | 166 | 159 |
| 11 | 220 | 295 | 129 | 206 | 109 | 167 | 16 | 11 | 8 | 127 | 242 | 270 | 198 | 144 | 258 | 184 | 138 |
| 12 | 102 | 342 | 300 | 93 | 15 | 253 | 60 | 189 | 10 | 224 | 197 | 41 | 8 | 0 | 204 | 191 | 196 |
| 14 | 109 | 217 | 76 | 79 | 72 | 334 | 0 | 95 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 132 | 99 | 266 | 9 | 152 | 242 | 6 | 85 | 20 | 0 | 151 | 187 | 301 | 105 | 265 | 89 | 6 | 77 |
| 16 | 142 | 354 | 72 | 118 | 158 | 257 | 30 | 153 | 3 | 186 | 206 | 162 | 210 | 81 | 65 | 12 | 187 |
| 17 | 155 | 114 | 83 | 194 | 147 | 133 | 0 | 87 | 9 | 217 | 264 | 40 | 121 | 90 | 155 | 15 | 203 |
| 19 | 255 | 331 | 260 | 31 | 156 | 9 | 168 | 163 | 11 | 47 | 341 | 130 | 214 | 144 | 244 | 5 | 167 |
| 21 | 28 | 112 | 301 | 187 | 119 | 302 | 31 | 216 | 22 | 160 | 59 | 10 | 183 | 228 | 30 | 30 | 130 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 105 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 1 | 249 | 205 | 79 | 192 | 64 | 162 | 6 | 197 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 121 | 102 | 175 | 131 | 46 | 264 | 86 | 122 |
| 2 | 0 | 106 | 205 | 68 | 207 | 258 | 226 | 132 | 189 | 16 | 109 | 328 | 132 | 220 | 266 | 346 | 96 | 215 |
| 1 | 111 | 250 | 7 | 203 | 167 | 35 | 37 | 4 | 20 | 131 | 213 | 283 | 50 | 9 | 143 | 42 | 65 |
| 2 | 185 | 328 | 80 | 31 | 220 | 213 | 21 | 225 | 21 | 171 | 97 | 103 | 106 | 18 | 109 | 199 | 216 |
| 4 | 63 | 332 | 280 | 176 | 133 | 302 | 180 | 151 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 117 | 256 | 38 | 180 | 243 | 111 | 4 | 236 | 22 | 0 | 64 | 30 | 177 | 53 | 72 | 280 | 44 | 25 |
| 6 | 93 | 161 | 227 | 186 | 202 | 265 | 149 | 117 | 12 | 142 | 11 | 20 | 0 | 189 | 157 | 58 | 47 |
| 7 | 229 | 267 | 202 | 95 | 218 | 128 | 48 | 179 | 13 | 188 | 233 | 55 | 3 | 72 | 236 | 130 | 126 |
| 8 | 177 | 160 | 200 | 153 | 63 | 237 | 38 | 92 | 17 | 158 | 22 | 316 | 148 | 257 | 113 | 131 | 178 |
| 9 | 95 | 63 | 71 | 177 | 0 | 294 | 122 | 24 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 39 | 129 | 106 | 70 | 3 | 127 | 195 | 68 | 23 | 1 | 156 | 24 | 249 | 88 | 180 | 18 | 45 | 185 |
| 13 | 142 | 200 | 295 | 77 | 74 | 110 | 155 | 6 | 2 | 147 | 89 | 50 | 203 | 0 | 6 | 18 | 127 |
| 14 | 225 | 88 | 283 | 214 | 229 | 286 | 28 | 101 | 10 | 170 | 61 | 133 | 168 | 0 | 181 | 132 | 117 |
| 15 | 225 | 53 | 301 | 77 | 0 | 125 | 85 | 33 | 18 | 152 | 27 | 105 | 122 | 165 | 304 | 100 | 199 |
| 17 | 245 | 131 | 184 | 198 | 216 | 131 | 47 | 96 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 205 | 240 | 246 | 117 | 269 | 163 | 179 | 125 | 24 | 0 | 112 | 298 | 289 | 49 | 236 | 38 | 9 | 32 |
| 19 | 251 | 205 | 230 | 223 | 200 | 210 | 42 | 67 | 3 | 86 | 158 | 280 | 157 | 199 | 170 | 125 | 178 |
| 20 | 117 | 13 | 276 | 90 | 234 | 7 | 66 | 230 | 4 | 236 | 235 | 110 | 64 | 0 | 249 | 191 | 2 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 116 | 339 | 187 | 193 | 266 | 288 | 28 | 156 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 222 | 234 | 281 | 124 | 0 | 194 | 6 | 58 |
| 3 | 0 | 121 | 276 | 220 | 201 | 187 | 97 | 4 | 128 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 89 | 87 | 208 | 18 | 145 | 94 | 6 | 23 | 25 | 1 | 23 | 72 | 172 | 1 | 205 | 279 | 4 | 27 |
| 3 | 84 | 0 | 30 | 165 | 166 | 49 | 33 | 162 | 6 | 136 | 17 | 295 | 166 | 0 | 255 | 74 | 141 |
| 4 | 20 | 275 | 197 | 5 | 108 | 279 | 113 | 220 | 7 | 116 | 383 | 96 | 65 | 0 | 111 | 16 | 11 |
| 6 | 150 | 199 | 61 | 45 | 82 | 139 | 49 | 43 | 14 | 182 | 312 | 46 | 81 | 183 | 54 | 28 | 181 |
| 7 | 131 | 153 | 175 | 142 | 132 | 166 | 21 | 186 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 243 | 56 | 79 | 16 | 197 | 91 | 6 | 96 | 26 | 0 | 195 | 71 | 270 | 107 | 0 | 325 | 21 | 163 |
| 10 | 136 | 132 | 281 | 34 | 41 | 106 | 151 | 1 | 2 | 243 | 81 | 110 | 176 | 0 | 326 | 142 | 131 |
| 11 | 86 | 305 | 303 | 155 | 162 | 246 | 83 | 216 | 4 | 215 | 76 | 318 | 212 | 0 | 226 | 192 | 169 |
| 12 | 246 | 231 | 253 | 213 | 57 | 345 | 154 | 22 | 15 | 61 | 136 | 67 | 127 | 277 | 99 | 197 | 98 |
| 13 | 219 | 341 | 164 | 147 | 36 | 269 | 87 | 24 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 211 | 212 | 53 | 69 | 115 | 185 | 5 | 167 | 27 | 1 | 25 | 194 | 210 | 208 | 45 | 91 | 98 | 165 |
| 16 | 240 | 304 | 44 | 96 | 242 | 249 | 92 | 200 | 6 | 104 | 194 | 29 | 141 | 36 | 326 | 140 | 232 |
| 17 | 76 | 300 | 28 | 74 | 165 | 215 | 173 | 32 | 8 | 194 | 101 | 304 | 174 | 72 | 268 | 22 | 9 |
| 18 | 244 | 271 | 77 | 99 | 0 | 143 | 120 | 235 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 144 | 39 | 319 | 30 | 113 | 121 | 2 | 172 | 28 | 0 | 128 | 222 | 11 | 146 | 275 | 102 | 4 | 32 |
| 21 | 12 | 357 | 68 | 158 | 108 | 121 | 142 | 219 | 4 | 165 | 19 | 293 | 153 | 0 | 1 | 1 | 43 |
| 22 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 19 | 181 | 244 | 50 | 217 | 155 | 40 | 40 | 200 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 63 | 274 | 234 | 114 | 62 | 167 | 93 | 205 |
| 4 | 0 | 157 | 332 | 233 | 170 | 246 | 42 | 24 | 64 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 102 | 181 | 205 | 10 | 235 | 256 | 204 | 211 | 29 | 1 | 86 | 252 | 27 | 150 | 0 | 273 | 92 | 232 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 236 | 5 | 308 | 11 | 180 | 104 | 136 | 32 |
| 5 | 0 | 205 | 195 | 83 | 164 | 261 | 219 | 185 | 2 | 18 | 84 | 147 | 117 | 53 | 0 | 243 | 106 | 118 |
| 1 | 236 | 14 | 292 | 59 | 181 | 130 | 100 | 171 | 25 | 6 | 78 | 29 | 68 | 42 | 107 | 6 | 103 |
| 3 | 194 | 115 | 50 | 86 | 72 | 251 | 24 | 47 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 231 | 166 | 318 | 80 | 283 | 322 | 65 | 143 | 30 | 0 | 216 | 159 | 91 | 34 | 0 | 171 | 2 | 170 |
| 16 | 28 | 241 | 201 | 182 | 254 | 295 | 207 | 210 | 10 | 73 | 229 | 23 | 130 | 90 | 16 | 88 | 199 |
| 21 | 123 | 51 | 267 | 130 | 79 | 258 | 161 | 180 | 13 | 120 | 260 | 105 | 210 | 252 | 95 | 112 | 26 |
| 22 | 115 | 157 | 279 | 153 | 144 | 283 | 72 | 180 | 24 | 9 | 90 | 135 | 123 | 173 | 212 | 20 | 105 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 183 | 278 | 289 | 158 | 80 | 294 | 6 | 199 | 31 | 1 | 95 | 100 | 222 | 175 | 144 | 101 | 4 | 73 |
| 6 | 22 | 257 | 21 | 119 | 144 | 73 | 27 | 22 | 7 | 177 | 215 | 308 | 49 | 144 | 297 | 49 | 149 |
| 10 | 28 | 1 | 293 | 113 | 169 | 330 | 163 | 23 | 22 | 172 | 258 | 66 | 177 | 166 | 279 | 125 | 175 |
| 11 | 67 | 351 | 13 | 21 | 90 | 99 | 50 | 100 | 25 | 61 | 256 | 162 | 128 | 19 | 222 | 194 | 108 |
| 13 | 244 | 92 | 232 | 63 | 59 | 172 | 48 | 92 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 11 | 253 | 302 | 51 | 177 | 150 | 24 | 207 | 32 | 0 | 221 | 102 | 210 | 192 | 0 | 351 | 6 | 103 |
| 18 | 157 | 18 | 138 | 136 | 151 | 284 | 38 | 52 | 12 | 112 | 201 | 22 | 209 | 211 | 265 | 126 | 110 |
| 20 | 211 | 225 | 235 | 116 | 108 | 305 | 91 | 13 | 14 | 199 | 175 | 271 | 58 | 36 | 338 | 63 | 151 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 121 | 287 | 217 | 30 | 162 | 83 | 20 | 211 |
| 7 | 0 | 220 | 9 | 12 | 17 | 169 | 3 | 145 | 77 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 44 | 62 | 88 | 76 | 189 | 103 | 88 | 146 | 33 | 1 | 2 | 323 | 170 | 114 | 0 | 56 | 10 | 199 |
| 4 | 159 | 316 | 207 | 104 | 154 | 224 | 112 | 209 | 2 | 187 | 8 | 20 | 49 | 0 | 304 | 30 | 132 |
| 7 | 31 | 333 | 50 | 100 | 184 | 297 | 153 | 32 | 11 | 41 | 361 | 140 | 161 | 76 | 141 | 6 | 172 |
| 8 | 167 | 290 | 25 | 150 | 104 | 215 | 159 | 166 | 21 | 211 | 105 | 33 | 137 | 18 | 101 | 92 | 65 |
| 14 | 104 | 114 | 76 | 158 | 164 | 39 | 76 | 18 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 127 | 230 | 187 | 82 | 197 | 60 | 4 | 161 |
| 8 | 0 | 112 | 307 | 295 | 33 | 54 | 348 | 172 | 181 | 7 | 167 | 148 | 296 | 186 | 0 | 320 | 153 | 237 |
| 1 | 4 | 179 | 133 | 95 | 0 | 75 | 2 | 105 | 15 | 164 | 202 | 5 | 68 | 108 | 112 | 197 | 142 |
| 3 | 7 | 165 | 130 | 4 | 252 | 22 | 131 | 141 | 17 | 159 | 312 | 44 | 150 | 0 | 54 | 155 | 180 |
| 12 | 211 | 18 | 231 | 217 | 41 | 312 | 141 | 223 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 102 | 39 | 296 | 204 | 98 | 224 | 96 | 177 | 35 | 1 | 161 | 320 | 207 | 192 | 199 | 100 | 4 | 231 |
| 19 | 164 | 224 | 110 | 39 | 46 | 17 | 99 | 145 | 6 | 197 | 335 | 158 | 173 | 278 | 210 | 45 | 174 |
| 21 | 109 | 368 | 269 | 58 | 15 | 59 | 101 | 199 | 12 | 207 | 2 | 55 | 26 | 0 | 195 | 168 | 145 |
| 22 | 241 | 67 | 245 | 44 | 230 | 314 | 35 | 153 | 22 | 103 | 266 | 285 | 187 | 205 | 268 | 185 | 100 |
| 24 | 90 | 170 | 154 | 201 | 54 | 244 | 116 | 38 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 37 | 210 | 259 | 222 | 216 | 135 | 6 | 11 |
| 9 | 0 | 103 | 366 | 189 | 9 | 162 | 156 | 6 | 169 | 14 | 105 | 313 | 179 | 157 | 16 | 15 | 200 | 207 |
| 1 | 182 | 232 | 244 | 37 | 159 | 88 | 10 | 12 | 15 | 51 | 297 | 178 | 0 | 0 | 35 | 177 | 42 |
| 10 | 109 | 321 | 36 | 213 | 93 | 293 | 145 | 206 | 18 | 120 | 21 | 160 | 6 | 0 | 188 | 43 | 100 |
| 11 | 21 | 133 | 286 | 105 | 134 | 111 | 53 | 221 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 142 | 57 | 151 | 89 | 45 | 92 | 201 | 17 | 37 | 1 | 198 | 269 | 298 | 81 | 72 | 319 | 82 | 59 |
| 17 | 14 | 303 | 267 | 185 | 132 | 152 | 4 | 212 | 13 | 220 | 82 | 15 | 195 | 144 | 236 | 2 | 204 |
| 18 | 61 | 63 | 135 | 109 | 76 | 23 | 164 | 92 | 23 | 122 | 115 | 115 | 138 | 0 | 85 | 135 | 161 |
| 20 | 216 | 82 | 209 | 218 | 209 | 337 | 173 | 205 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 | 167 | 185 | 151 | 123 | 190 | 164 | 91 | 121 |
| 10 | 1 | 98 | 101 | 14 | 82 | 178 | 175 | 126 | 116 | 9 | 151 | 177 | 179 | 90 | 0 | 196 | 64 | 90 |
| 2 | 149 | 339 | 80 | 165 | 1 | 253 | 77 | 151 | 10 | 157 | 289 | 64 | 73 | 0 | 209 | 198 | 26 |
| 4 | 167 | 274 | 211 | 174 | 28 | 27 | 156 | 70 | 12 | 163 | 214 | 181 | 10 | 0 | 246 | 100 | 140 |
| 7 | 160 | 111 | 75 | 19 | 267 | 231 | 16 | 230 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 49 | 383 | 161 | 194 | 234 | 49 | 12 | 115 | 39 | 1 | 173 | 258 | 102 | 12 | 153 | 236 | 4 | 115 |
| 14 | 58 | 354 | 311 | 103 | 201 | 267 | 70 | 84 | 3 | 139 | 93 | 77 | 77 | 0 | 264 | 28 | 188 |
| 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 149 | 346 | 192 | 49 | 165 | 37 | 109 | 168 |
| 11 | 0 | 77 | 48 | 16 | 52 | 55 | 25 | 184 | 45 | 19 | 0 | 297 | 208 | 114 | 117 | 272 | 188 | 52 |
| 1 | 41 | 102 | 147 | 11 | 23 | 322 | 194 | 115 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 83 | 8 | 290 | 2 | 274 | 200 | 123 | 134 | 40 | 0 | 157 | 175 | 32 | 67 | 216 | 304 | 10 | 4 |
| 16 | 182 | 47 | 289 | 35 | 181 | 351 | 16 | 1 | 8 | 137 | 37 | 80 | 45 | 144 | 237 | 84 | 103 |
| 21 | 78 | 188 | 177 | 32 | 273 | 166 | 104 | 152 | 17 | 149 | 312 | 197 | 96 | 2 | 135 | 12 | 30 |
| 22 | 252 | 334 | 43 | 84 | 39 | 338 | 109 | 165 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 22 | 115 | 280 | 201 | 26 | 192 | 124 | 107 | 41 | 1 | 167 | 52 | 154 | 23 | 0 | 123 | 2 | 53 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 173 | 314 | 47 | 215 | 0 | 77 | 75 | 189 |
| 12 | 0 | 160 | 77 | 229 | 142 | 225 | 123 | 6 | 186 | 9 | 139 | 139 | 124 | 60 | 0 | 25 | 142 | 215 |
| 1 | 42 | 186 | 235 | 175 | 162 | 217 | 20 | 215 | 18 | 151 | 288 | 207 | 167 | 183 | 272 | 128 | 24 |
| 10 | 21 | 174 | 169 | 136 | 244 | 142 | 203 | 124 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 32 | 232 | 48 | 3 | 151 | 110 | 153 | 180 | 42 | 0 | 149 | 113 | 226 | 114 | 27 | 288 | 163 | 222 |
| 13 | 234 | 50 | 105 | 28 | 238 | 176 | 104 | 98 | 4 | 157 | 14 | 65 | 91 | 0 | 83 | 10 | 170 |
| 18 | 7 | 74 | 52 | 182 | 243 | 76 | 207 | 80 | 24 | 137 | 218 | 126 | 78 | 35 | 17 | 162 | 71 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 177 | 313 | 39 | 81 | 231 | 311 | 52 | 220 | 43 | 1 | 151 | 113 | 228 | 206 | 52 | 210 | 1 | 22 |
| 3 | 248 | 177 | 302 | 56 | 0 | 251 | 147 | 185 | 16 | 163 | 132 | 69 | 22 | 243 | 3 | 163 | 127 |
| 7 | 151 | 266 | 303 | 72 | 216 | 265 | 1 | 154 | 18 | 173 | 114 | 176 | 134 | 0 | 53 | 99 | 49 |
| 20 | 185 | 115 | 160 | 217 | 47 | 94 | 16 | 178 | 25 | 139 | 168 | 102 | 161 | 270 | 167 | 98 | 125 |
| 23 | 62 | 370 | 37 | 78 | 36 | 81 | 46 | 150 | 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 0 | 139 | 80 | 234 | 84 | 18 | 79 | 4 | 191 |
| 14 | 0 | 206 | 142 | 78 | 14 | 0 | 22 | 1 | 124 | 7 | 157 | 78 | 227 | 4 | 0 | 244 | 6 | 211 |
| 12 | 55 | 248 | 299 | 175 | 186 | 322 | 202 | 144 | 9 | 163 | 163 | 259 | 9 | 0 | 293 | 142 | 187 |
| 15 | 206 | 137 | 54 | 211 | 253 | 277 | 118 | 182 | 22 | 173 | 274 | 260 | 12 | 57 | 272 | 3 | 148 |
| 16 | 127 | 89 | 61 | 191 | 16 | 156 | 130 | 95 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 16 | 347 | 179 | 51 | 0 | 66 | 1 | 72 | 45 | 1 | 149 | 135 | 101 | 184 | 168 | 82 | 181 | 177 |
| 21 | 229 | 12 | 258 | 43 | 79 | 78 | 2 | 76 | 6 | 151 | 149 | 228 | 121 | 0 | 67 | 45 | 114 |
| 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 167 | 15 | 126 | 29 | 144 | 235 | 153 | 93 |
| 15 | 0 | 40 | 241 | 229 | 90 | 170 | 176 | 173 | 39 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 5.3.2-3: LDPC base graph 2 () and its parity check matrices ()

|  | |  | | | | | | | |  | |  | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Row  index | Column  index | Set index | | | | | | | | Row  index | Column  index | Set index | | | | | | | |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 0 | 0 | 9 | 174 | 0 | 72 | 3 | 156 | 143 | 145 | 16 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 117 | 97 | 0 | 110 | 26 | 143 | 19 | 131 | 17 | 1 | 254 | 158 | 0 | 48 | 120 | 134 | 57 | 196 |
| 2 | 204 | 166 | 0 | 23 | 53 | 14 | 176 | 71 | 5 | 124 | 23 | 24 | 132 | 43 | 23 | 201 | 173 |
| 3 | 26 | 66 | 0 | 181 | 35 | 3 | 165 | 21 | 11 | 114 | 9 | 109 | 206 | 65 | 62 | 142 | 195 |
| 6 | 189 | 71 | 0 | 95 | 115 | 40 | 196 | 23 | 12 | 64 | 6 | 18 | 2 | 42 | 163 | 35 | 218 |
| 9 | 205 | 172 | 0 | 8 | 127 | 123 | 13 | 112 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 18 | 0 | 220 | 186 | 0 | 68 | 17 | 173 | 129 | 128 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 194 | 6 | 18 | 16 | 106 | 31 | 203 | 211 |
| 1 | 0 | 167 | 27 | 137 | 53 | 19 | 17 | 18 | 142 | 7 | 50 | 46 | 86 | 156 | 142 | 22 | 140 | 210 |
| 3 | 166 | 36 | 124 | 156 | 94 | 65 | 27 | 174 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 253 | 48 | 0 | 115 | 104 | 63 | 3 | 183 | 19 | 0 | 87 | 58 | 0 | 35 | 79 | 13 | 110 | 39 |
| 5 | 125 | 92 | 0 | 156 | 66 | 1 | 102 | 27 | 1 | 20 | 42 | 158 | 138 | 28 | 135 | 124 | 84 |
| 6 | 226 | 31 | 88 | 115 | 84 | 55 | 185 | 96 | 10 | 185 | 156 | 154 | 86 | 41 | 145 | 52 | 88 |
| 7 | 156 | 187 | 0 | 200 | 98 | 37 | 17 | 23 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 224 | 185 | 0 | 29 | 69 | 171 | 14 | 9 | 20 | 1 | 26 | 76 | 0 | 6 | 2 | 128 | 196 | 117 |
| 9 | 252 | 3 | 55 | 31 | 50 | 133 | 180 | 167 | 4 | 105 | 61 | 148 | 20 | 103 | 52 | 35 | 227 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 29 | 153 | 104 | 141 | 78 | 173 | 114 | 6 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 81 | 25 | 20 | 152 | 95 | 98 | 126 | 74 | 21 | 0 | 76 | 157 | 0 | 80 | 91 | 156 | 10 | 238 |
| 1 | 114 | 114 | 94 | 131 | 106 | 168 | 163 | 31 | 8 | 42 | 175 | 17 | 43 | 75 | 166 | 122 | 13 |
| 3 | 44 | 117 | 99 | 46 | 92 | 107 | 47 | 3 | 13 | 210 | 67 | 33 | 81 | 81 | 40 | 23 | 11 |
| 4 | 52 | 110 | 9 | 191 | 110 | 82 | 183 | 53 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 240 | 114 | 108 | 91 | 111 | 142 | 132 | 155 | 22 | 1 | 222 | 20 | 0 | 49 | 54 | 18 | 202 | 195 |
| 10 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 2 | 63 | 52 | 4 | 1 | 132 | 163 | 126 | 44 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 23 | 106 | 0 | 156 | 68 | 110 | 52 | 5 |
| 3 | 1 | 8 | 136 | 38 | 185 | 120 | 53 | 36 | 239 | 3 | 235 | 86 | 75 | 54 | 115 | 132 | 170 | 94 |
| 2 | 58 | 175 | 15 | 6 | 121 | 174 | 48 | 171 | 5 | 238 | 95 | 158 | 134 | 56 | 150 | 13 | 111 |
| 4 | 158 | 113 | 102 | 36 | 22 | 174 | 18 | 95 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 104 | 72 | 146 | 124 | 4 | 127 | 111 | 110 | 24 | 1 | 46 | 182 | 0 | 153 | 30 | 113 | 113 | 81 |
| 6 | 209 | 123 | 12 | 124 | 73 | 17 | 203 | 159 | 2 | 139 | 153 | 69 | 88 | 42 | 108 | 161 | 19 |
| 7 | 54 | 118 | 57 | 110 | 49 | 89 | 3 | 199 | 9 | 8 | 64 | 87 | 63 | 101 | 61 | 88 | 130 |
| 8 | 18 | 28 | 53 | 156 | 128 | 17 | 191 | 43 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 128 | 186 | 46 | 133 | 79 | 105 | 160 | 75 | 25 | 0 | 228 | 45 | 0 | 211 | 128 | 72 | 197 | 66 |
| 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 5 | 156 | 21 | 65 | 94 | 63 | 136 | 194 | 95 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 179 | 72 | 0 | 200 | 42 | 86 | 43 | 29 | 26 | 2 | 29 | 67 | 0 | 90 | 142 | 36 | 164 | 146 |
| 1 | 214 | 74 | 136 | 16 | 24 | 67 | 27 | 140 | 7 | 143 | 137 | 100 | 6 | 28 | 38 | 172 | 66 |
| 11 | 71 | 29 | 157 | 101 | 51 | 83 | 117 | 180 | 12 | 160 | 55 | 13 | 221 | 100 | 53 | 49 | 190 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 122 | 85 | 7 | 6 | 133 | 145 | 161 | 86 |
| 5 | 0 | 231 | 10 | 0 | 185 | 40 | 79 | 136 | 121 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 41 | 44 | 131 | 138 | 140 | 84 | 49 | 41 | 27 | 0 | 8 | 103 | 0 | 27 | 13 | 42 | 168 | 64 |
| 5 | 194 | 121 | 142 | 170 | 84 | 35 | 36 | 169 | 6 | 151 | 50 | 32 | 118 | 10 | 104 | 193 | 181 |
| 7 | 159 | 80 | 141 | 219 | 137 | 103 | 132 | 88 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 103 | 48 | 64 | 193 | 71 | 60 | 62 | 207 | 28 | 1 | 98 | 70 | 0 | 216 | 106 | 64 | 14 | 7 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 101 | 111 | 126 | 212 | 77 | 24 | 186 | 144 |
| 6 | 0 | 155 | 129 | 0 | 123 | 109 | 47 | 7 | 137 | 5 | 135 | 168 | 110 | 193 | 43 | 149 | 46 | 16 |
| 5 | 228 | 92 | 124 | 55 | 87 | 154 | 34 | 72 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 45 | 100 | 99 | 31 | 107 | 10 | 198 | 172 | 29 | 0 | 18 | 110 | 0 | 108 | 133 | 139 | 50 | 25 |
| 9 | 28 | 49 | 45 | 222 | 133 | 155 | 168 | 124 | 4 | 28 | 17 | 154 | 61 | 25 | 161 | 27 | 57 |
| 11 | 158 | 184 | 148 | 209 | 139 | 29 | 12 | 56 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 2 | 71 | 120 | 0 | 106 | 87 | 84 | 70 | 37 |
| 7 | 1 | 129 | 80 | 0 | 103 | 97 | 48 | 163 | 86 | 5 | 240 | 154 | 35 | 44 | 56 | 173 | 17 | 139 |
| 5 | 147 | 186 | 45 | 13 | 135 | 125 | 78 | 186 | 7 | 9 | 52 | 51 | 185 | 104 | 93 | 50 | 221 |
| 7 | 140 | 16 | 148 | 105 | 35 | 24 | 143 | 87 | 9 | 84 | 56 | 134 | 176 | 70 | 29 | 6 | 17 |
| 11 | 3 | 102 | 96 | 150 | 108 | 47 | 107 | 172 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 116 | 143 | 78 | 181 | 65 | 55 | 58 | 154 | 31 | 1 | 106 | 3 | 0 | 147 | 80 | 117 | 115 | 201 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 1 | 170 | 20 | 182 | 139 | 148 | 189 | 46 |
| 8 | 0 | 142 | 118 | 0 | 147 | 70 | 53 | 101 | 176 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 94 | 70 | 65 | 43 | 69 | 31 | 177 | 169 | 32 | 0 | 242 | 84 | 0 | 108 | 32 | 116 | 110 | 179 |
| 12 | 230 | 152 | 87 | 152 | 88 | 161 | 22 | 225 | 5 | 44 | 8 | 20 | 21 | 89 | 73 | 0 | 14 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 166 | 17 | 122 | 110 | 71 | 142 | 163 | 116 |
| 9 | 1 | 203 | 28 | 0 | 2 | 97 | 104 | 186 | 167 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 205 | 132 | 97 | 30 | 40 | 142 | 27 | 238 | 33 | 2 | 132 | 165 | 0 | 71 | 135 | 105 | 163 | 46 |
| 10 | 61 | 185 | 51 | 184 | 24 | 99 | 205 | 48 | 7 | 164 | 179 | 88 | 12 | 6 | 137 | 173 | 2 |
| 11 | 247 | 178 | 85 | 83 | 49 | 64 | 81 | 68 | 10 | 235 | 124 | 13 | 109 | 2 | 29 | 179 | 106 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 11 | 59 | 0 | 174 | 46 | 111 | 125 | 38 | 34 | 0 | 147 | 173 | 0 | 29 | 37 | 11 | 197 | 184 |
| 1 | 185 | 104 | 17 | 150 | 41 | 25 | 60 | 217 | 12 | 85 | 177 | 19 | 201 | 25 | 41 | 191 | 135 |
| 6 | 0 | 22 | 156 | 8 | 101 | 174 | 177 | 208 | 13 | 36 | 12 | 78 | 69 | 114 | 162 | 193 | 141 |
| 7 | 117 | 52 | 20 | 56 | 96 | 23 | 51 | 232 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 1 | 57 | 77 | 0 | 91 | 60 | 126 | 157 | 85 |
| 11 | 0 | 11 | 32 | 0 | 99 | 28 | 91 | 39 | 178 | 5 | 40 | 184 | 157 | 165 | 137 | 152 | 167 | 225 |
| 7 | 236 | 92 | 7 | 138 | 30 | 175 | 29 | 214 | 11 | 63 | 18 | 6 | 55 | 93 | 172 | 181 | 175 |
| 9 | 210 | 174 | 4 | 110 | 116 | 24 | 35 | 168 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 56 | 154 | 2 | 99 | 64 | 141 | 8 | 51 | 36 | 0 | 140 | 25 | 0 | 1 | 121 | 73 | 197 | 178 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 38 | 151 | 63 | 175 | 129 | 154 | 167 | 112 |
| 12 | 1 | 63 | 39 | 0 | 46 | 33 | 122 | 18 | 124 | 7 | 154 | 170 | 82 | 83 | 26 | 129 | 179 | 106 |
| 3 | 111 | 93 | 113 | 217 | 122 | 11 | 155 | 122 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 14 | 11 | 48 | 109 | 131 | 4 | 49 | 72 | 37 | 10 | 219 | 37 | 0 | 40 | 97 | 167 | 181 | 154 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 151 | 31 | 144 | 12 | 56 | 38 | 193 | 114 |
| 13 | 0 | 83 | 49 | 0 | 37 | 76 | 29 | 32 | 48 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 2 | 125 | 112 | 113 | 37 | 91 | 53 | 57 | 38 | 1 | 31 | 84 | 0 | 37 | 1 | 112 | 157 | 42 |
| 8 | 38 | 35 | 102 | 143 | 62 | 27 | 95 | 167 | 5 | 66 | 151 | 93 | 97 | 70 | 7 | 173 | 41 |
| 13 | 222 | 166 | 26 | 140 | 47 | 127 | 186 | 219 | 11 | 38 | 190 | 19 | 46 | 1 | 19 | 191 | 105 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 1 | 115 | 19 | 0 | 36 | 143 | 11 | 91 | 82 | 39 | 0 | 239 | 93 | 0 | 106 | 119 | 109 | 181 | 167 |
| 6 | 145 | 118 | 138 | 95 | 51 | 145 | 20 | 232 | 7 | 172 | 132 | 24 | 181 | 32 | 6 | 157 | 45 |
| 11 | 3 | 21 | 57 | 40 | 130 | 8 | 52 | 204 | 12 | 34 | 57 | 138 | 154 | 142 | 105 | 173 | 189 |
| 13 | 232 | 163 | 27 | 116 | 97 | 166 | 109 | 162 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 2 | 0 | 103 | 0 | 98 | 6 | 160 | 193 | 78 |
| 15 | 0 | 51 | 68 | 0 | 116 | 139 | 137 | 174 | 38 | 10 | 75 | 107 | 36 | 35 | 73 | 156 | 163 | 67 |
| 10 | 175 | 63 | 73 | 200 | 96 | 103 | 108 | 217 | 13 | 120 | 163 | 143 | 36 | 102 | 82 | 179 | 180 |
| 11 | 213 | 81 | 99 | 110 | 128 | 40 | 102 | 157 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 | 129 | 147 | 0 | 120 | 48 | 132 | 191 | 53 |
| 16 | 1 | 203 | 87 | 0 | 75 | 48 | 78 | 125 | 170 | 5 | 229 | 7 | 2 | 101 | 47 | 6 | 197 | 215 |
| 9 | 142 | 177 | 79 | 158 | 9 | 158 | 31 | 23 | 11 | 118 | 60 | 55 | 81 | 19 | 8 | 167 | 230 |
| 11 | 8 | 135 | 111 | 134 | 28 | 17 | 54 | 175 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 242 | 64 | 143 | 97 | 8 | 165 | 176 | 202 |  |  |  |  |  |  |  |  |  |  |

### 5.3.3 Channel coding of small block lengths

The bit sequence input for a given code block to channel coding is denoted by , where  is the number of bits to encode. After encoding the bits are denoted by .

#### 5.3.3.1 Encoding of 1-bit information

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

Table 5.3.3.1-1: Encoding of 1-bit information

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

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

#### 5.3.3.2 Encoding of 2-bit information

For , the code block is encoded according to Table 5.3.3.2-1, where , , and  is the modulation order for the code block.

Table 5.3.3.2-1: Encoding of 2-bit information

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

The "x" in Table 5.3.3.2-1 are placeholders for Clause 6.3.1.1 of [4, TS 38.211] to scramble the information bits in a way that maximizes the Euclidean distance of the modulation symbols carrying the information bits.

#### 5.3.3.3 Encoding of other small block lengths

For , the code block is encoded by , where , , and  represents the basis sequences as defined in Table 5.3.3.3-1.

Table 5.3.3.3-1: Basis sequences for (32, ) code

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Mi,0 | Mi,1 | Mi,2 | Mi,3 | Mi,4 | Mi,5 | Mi,6 | Mi,7 | Mi,8 | Mi,9 | Mi,10 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 3 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 5 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| 6 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 7 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 8 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 9 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 10 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| 11 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 12 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 13 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| 14 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 15 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 16 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| 17 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 18 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 19 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 20 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 21 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 22 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| 23 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 24 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| 25 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 26 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 27 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 28 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 29 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 30 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 31 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## 5.4 Rate matching

### 5.4.1 Rate matching for Polar code

The rate matching for Polar code is defined per coded block and consists of sub-block interleaving, bit collection, and bit interleaving. The input bit sequence to rate matching is . The output bit sequence after rate matching is denoted as .

#### 5.4.1.1 Sub-block interleaving

The bits input to the sub-block interleaver are the coded bits . The coded bits  are divided into 32 sub-blocks. The bits output from the sub-block interleaver are denoted as , generated as follows:

for  to 

;

;

;

end for

where the sub-block interleaver pattern  is given by Table 5.4.1.1-1.

Table 5.4.1.1-1: Sub-block interleaver pattern 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 4 | 3 | 8 | 8 | 12 | 10 | 16 | 12 | 20 | 14 | 24 | 24 | 28 | 27 |
| 1 | 1 | 5 | 5 | 9 | 16 | 13 | 18 | 17 | 20 | 21 | 22 | 25 | 25 | 29 | 29 |
| 2 | 2 | 6 | 6 | 10 | 9 | 14 | 11 | 18 | 13 | 22 | 15 | 26 | 26 | 30 | 30 |
| 3 | 4 | 7 | 7 | 11 | 17 | 15 | 19 | 19 | 21 | 23 | 23 | 27 | 28 | 31 | 31 |

The sets of bit indices  and  are determined as follows, where , , and  are defined in Clause 5.3.1



if 

if  -- puncturing

for  to 

;

end for

if 

;

else

;

end if

else -- shortening

for  to 

;

end for

end if

end if

;

 comprises  most reliable bit indices in ;

;

#### 5.4.1.2 Bit selection

The bit sequence after the sub-block interleaver  from Clause 5.4.1.1 is written into a circular buffer of length .

Denoting by  the rate matching output sequence length, the bit selection output bit sequence , , is generated as follows:

if  -- repetition

for  to 

;

end for

else

if  -- puncturing

for  to 

;

end for

else -- shortening

for  to 

;

end for

end if

end if

#### 5.4.1.3 Interleaving of coded bits

The bit sequence  is interleaved into bit sequence , as follows:

If 

Denote  as the smallest integer such that ;

;

for  to 

for  to 

if 

;

else

;

end if

;

end for

end for

;

for  to 

for  to 

if 

;



end if

end for

end for

else

for  to 

;

end for

end if

The value of  is no larger than 8192.

### 5.4.2 Rate matching for LDPC code

The rate matching for LDPC code is defined per coded block and consists of bit selection and bit interleaving. The input bit sequence to rate matching is . The output bit sequence after rate matching is denoted as .

#### 5.4.2.1 Bit selection

The bit sequence after encoding  from Clause 5.3.2 is written into a circular buffer of length  for the -th coded block, where  is defined in Clause 5.3.2.

For the -th code block, let  if  and  otherwise, where, ,  is determined according to Clause 6.1.4.2 in [6, TS 38.214] for UL-SCH and Clause 5.1.3.2 in [6, TS 38.214] for DL-SCH/PCH, assuming the following:

For one TB for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2:

- if the PDSCH is scheduled by DCI format 4\_1/4\_2:

- maximum number of layers is given by X, where:

- if the higher layer parameter *maxMIMO-Layers* of *pdsch-ConfigMulticast* is configured*,* X is given by that parameter;

- otherwise, X equals to 1;

- if the higher layer parameter *mcs-Table* given bya *pdsch-ConfigMulticast* or by *pdsch-ConfigMTCH* for at least one common frequency resource (CFR) is set to 'qam256', maximum modulation orderis assumed for DL-SCH; otherwise a maximum modulation orderis assumed for DL-SCH;

- if the PDSCH is scheduled by DCI format 4\_0:

- maximum number of layers is 1;

- if the higher layer parameter *mcs-Table* given by a *pdsch-ConfigMCCH* is set to 'qam256', maximum modulation order is assumed for DL-SCH; otherwise a maximum modulation order is assumed for DL-SCH;

- if the higher layer parameter *mcs-Table* given by a *pdsch-ConfigMTCH* is set to 'qam256', maximum modulation orderis assumed for DL-SCH; otherwise a maximum modulation order is assumed for DL-SCH;

- is given by Table 5.4.2.1-1, where the value of for DL-SCH is determined according to the size of the associated CFR if configured to the UE;

- maximum coding rate of 948/1024;

- ;

- is the number of code blocks of the transport block determined according to Clause 5.2.2.

For one TB for UL-SCH, or for one TB for DL-SCH/PCH except for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2:

- maximum number of layers for one TB for UL-SCH is given by the minimum of X and 4, where:

- if the higher layer parameter *maxMIMO-Layers* of *PUSCH-ServingCellConfig* of the serving cell is configured, X is given by that parameter;

- elseif the higher layer parameter *maxRank* of *pusch-Config* of the serving cell is configured, X is given by the maximum value of *maxRank* across all BWPs of the serving cell;

- otherwise, X is given by the maximum number of layers for PUSCH supported by the UE for the serving cell;

- maximum number of layers for one TB for DL-SCH/PCH is given by the minimum of X and 4, where:

- if the higher layer parameter *maxMIMO-Layers* of *PDSCH-ServingCellConfig* of the serving cell is configured, X is given by that parameter;

- otherwise, X is given by the maximum number of layers for PDSCH supported by the UE for the serving cell;

- if the higher layer parameter *mcs-Table-r17* or *mcs-TableDCI-1-2-r17* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam1024', maximum modulation order is assumed for DL-SCH, else if the higher layer parameter *mcs-Table* or *mcs-TableDCI-1-2* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for DL-SCH; otherwise a maximum modulation order  is assumed for DL-SCH;

- if the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* or *mcs-TableDCI-0-2* or *mcs-TableTransformPrecoderDCI-0-2* given by a *pusch-Config* or the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* given by *configuredGrantConfig* for at least one UL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for UL-SCH; otherwise a maximum modulation order  is assumed for UL-SCH;

- maximum coding rate of 948/1024;

-  is given by Table 5.4.2.1-1, where the value of  for DL-SCH is determined according to the initial downlink bandwidth part if there is no other downlink bandwidth part configured to the UE;

- ;

-  is the number of code blocks of the transport block determined according to Clause 5.2.2.

Table 5.4.2.1-1: Value of 

|  |  |
| --- | --- |
| Maximum number of PRBs across all configured DL BWPs and UL BWPs of a carrier for DL-SCH and UL-SCH, respectively,  or  Maximum number of PRBs across all CFRs of a carrier for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2 |  |
| Less than 33 | 32 |
| 33 to 66 | 66 |
| 67 to 107 | 107 |
| 108 to 135 | 135 |
| 136 to 162 | 162 |
| 163 to 217 | 217 |
| Larger than 217 | 273 |

Denoting by  the rate matching output sequence length for the -th coded block, where the value of  is determined as follows:

Set 

for  to 

if the -th coded block is not scheduled for transmission as indicated by CBGTI according to Clause 5.1.7.2 for DL-SCH and 6.1.5.2 for UL-SCH in [6, TS 38.214]:

;

else

if 

;

else

;

end if

;

end if

end for

where:

-  is the number of transmission layers that the transport block is mapped onto;

-  is the modulation order;

-  is the total number of coded bits available for transmission of the transport block;

-  if CBGTI is not present in the DCI scheduling the transport block and  is the number of scheduled code blocks of the transport block if CBGTI is present in the DCI scheduling the transport block.

Denote by  the redundancy version number for this transmission (= 0, 1, 2 or 3), the rate matching output bit sequence , , is generated as follows, where  is given by Table 5.4.2.1-2 according to the value of  and LDPC base graph:

;

;

while 

if 

;

;

end if

;

end while

Table 5.4.2.1-2: Starting position of different redundancy versions, 

|  |  |  |
| --- | --- | --- |
|  |  | |
| LDPC base graph 1 | LDPC base graph 2 |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |

#### 5.4.2.2 Bit interleaving

The bit sequence  is interleaved to bit sequence , according to the following, where the value of  is the modulation order:

for  to 

for  to 

;

end for

end for

### 5.4.3 Rate matching for channel coding of small block lengths

The input bit sequence to rate matching is . The output bit sequence after rate matching is denoted as , where  is the rate matching output sequence length. The bit sequence  is obtained by the following:

for  to 

;

end for

## 5.5 Code block concatenation

The input bit sequence for the code block concatenation block are the sequences , for  and , where  is the number of rate matched bits for the -th code block. The output bit sequence from the code block concatenation block is the sequence  for .

The code block concatenation consists of sequentially concatenating the rate matching outputs for the different code blocks. Therefore:

Set  and 

while 

Set 

while 







end while



end while

# 6 Uplink transport channels and control information

## 6.1 Random access channel

The sequence index for the random access channel is received from higher layers and is processed according to [4, TS 38.211].

## 6.2 Uplink shared channel

### 6.2.1 Transport block CRC attachment

Error detection is provided on each UL-SCH transport block through a Cyclic Redundancy Check (CRC).

The entire transport block is used to calculate the CRC parity bits. Denote the bits in a transport block delivered to layer 1 by, and the parity bits by, where  is the payload size and  is the number of parity bits. The lowest order information bit  is mapped to the most significant bit of the transport block as defined in Clause 6.1.1 of [TS38.321].

The parity bits are computed and attached to the UL-SCH transport block according to Clause 5.1, by setting  to 24 bits and using the generator polynomial  if ; and by setting  to 16 bits and using the generator polynomial  otherwise.

The bits after CRC attachment are denoted by , where .

### 6.2.2 LDPC base graph selection

For initial transmission of a transport block with coding rate  indicated by the MCS index according to Clause 6.1.4.1 in [6, TS 38.214] and subsequent re-transmission of the same transport block, each code block of the transport block is encoded with either LDPC base graph 1 or 2 according to the following:

- if , or if  and , or if , LDPC base graph 2 is used;

- otherwise, LDPC base graph 1 is used,

where  is the payload size as described in Clause 6.2.1.

### 6.2.3 Code block segmentation and code block CRC attachment

The bits input to the code block segmentation are denoted by  where  is the number of bits in the transport block (including CRC).

Code block segmentation and code block CRC attachment are performed according to Clause 5.2.2.

The bits after code block segmentation are denoted by, where  is the code block number and  is the number of bits for code block number  according to Clause 5.2.2.

When the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the value of *B* is no larger than 3840 if and no larger than 8448 otherwise, where coding rate is indicated by the MCS index according to Clause 6.1.4.1 in [6, TS 38.214].

### 6.2.4 Channel coding of UL-SCH

Code blocks are delivered to the channel coding block. The bits in a code block are denoted by , where  is the code block number, and  is the number of bits in code block number . The total number of code blocks is denoted by  and each code block is individually LDPC encoded according to Clause 5.3.2.

After encoding the bits are denoted by , where the values of  is given in Clause 5.3.2.

### 6.2.5 Rate matching

Coded bits for each code block, denoted as , are delivered to the rate match block, where  is the code block number, and  is the number of encoded bits in code block number . The total number of code blocks is denoted by  and each code block is individually rate matched according to Clause 5.4.2 by setting  if higher layer parameter *rateMatching* is set to *limitedBufferRM* and by setting  otherwise, if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1. When the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, each code block is individually rate matched per slot according to Clause 5.4.2 by setting:

- if higher layer parameter *rateMatching* is set to *limitedBufferRM* and by setting otherwise;

- as the total number of coded bits available for transmission of the transport block in the slot;

- as given by Table 5.4.2.1-2 according to the value of and LDPC base graph if the slot is the first slot within the slots allocated for the transmission of TB processing over multiple slots, and setting if the slot is a slot except for the first one within the slots, where is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI, denotes the index of starting coded bit in the previous slot within the slots, is the total number of coded bits available for transmission of the transport block in the previous slot within the slots assuming no UCI multiplexing, and denotes the number of skipped filler bits if any in the previous slot within the slots according to Clause 5.4.2.1 by assuming no UCI multiplexing.

After rate matching, the bits are denoted by, where is the number of rate matched bits for code block number .

### 6.2.6 Code block concatenation

The input bit sequence for the code block concatenation block are the sequences , for  and where  is the number of rate matched bits for the -th code block.

Code block concatenation is performed according to Clause 5.5.

The bits after code block concatenation are denoted by, where  is the total number of coded bits for transmission.

### 6.2.7 Data and control multiplexing

In case where there are more than one UL-SCH transport blocks for the PUSCH transmission, the UCI information is multiplexed only on the UL-SCH transport block with highest *IMCS* value for the initial PUSCH, where *IMCS* is as defined in Clause 6.1.4.1 in [6, TS 38.214]. In case the two transport blocks have the same *IMCS* value for the initial PUSCH, the UCI information is multiplexed with data only on the first transport block. The PUSCH for UCI multiplexing in this Clause referes to the UL-SCH transport block for UCI multiplexing.

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedure in this clause 6.2.7 applies by replacing CG‑UCI with UTO-UCI in all the notations and texts, and replacing "when higher layer parameter *cg-UCI-Multiplexing* is configured" with "when UTO-UCI and HARQ-ACK are transmitted on a PUSCH".

Denote the coded bits for UL-SCH as .

Denote the coded bits for HARQ-ACK or jointly coded bits for HARQ-ACK and CG-UCI when the high layer parameter *cg-UCI-Multiplexing* is configured, if any, as .

Denote the coded bits for CSI part 1, if any, as .

Denote the coded bits for CSI part 2, if any, as .

Denote the coded bits for CG-UCI without HARQ-ACK, if any, as .

Denote the multiplexed data and control coded bit sequence as .

Denote  as the OFDM symbol index of the scheduled PUSCH, starting from 0 to , where  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS.

Denote  as the subcarrier index of the scheduled PUSCH, starting from 0 to , where  is expressed as a number of subcarriers.

Denote  as the set of resource elements, in ascending order of indices , available for transmission of data in OFDM symbol , for .

Denote  as the number of elements in set . Denote  as the -th element in .

Denote  as the set of resource elements, in ascending order of indices , available for transmission of UCI in OFDM symbol , for . Denote  as the number of elements in set . Denote  as the -th element in . For any OFDM symbol that carriers DMRS of the PUSCH, . For any OFDM symbol that does not carry DMRS of the PUSCH, .

If frequency hopping is configured for the PUSCH,

- denote  as the OFDM symbol index of the first OFDM symbol after the first set of consecutive OFDM symbol(s) carrying DMRS in the first hop;

- denote  as the OFDM symbol index of the first OFDM symbol after the first set of consecutive OFDM symbol(s) carrying DMRS in the second hop;

- denote  as the OFDM symbol index of the first OFDM symbol that does not carry DMRS in the first hop;

- denote  as the OFDM symbol index of the first OFDM symbol that does not carry DMRS in the second hop;

- if HARQ-ACK is present for transmission on the PUSCH with UL-SCH or if both HARQ-ACK and CG-UCI are present on the same PUSCH with UL-SCH, let:

-  and ;

- if CSI is present for transmission on the PUSCH with UL-SCH, let:

- ;

- ;

- ; and

- ;

- if CG-UCI is present for transmission on the PUSCH with UL-SCH and without HARQ-ACK, let:

- and

- if only HARQ-ACK and CSI part 1 are present for transmission on the PUSCH without UL-SCH, let:

- ;

- ;

- ; and

- ;

- if HARQ-ACK, CSI part 1 and CSI part 2 are present for transmission on the PUSCH without UL-SCH, let:

- ;

- ;

- if the number of HARQ-ACK information bits is more than 2,; otherwise, 

- ;

-  if the number of HARQ-ACK information bits is no more than 2, and  otherwise; and

-  if the number of HARQ-ACK information bits is no more than 2, and  otherwise;

- if only CSI part 1 and CSI part 2 are present for transmission on the PUSCH without UL-SCH, let:

- ;

- ;

- ; and

- ;

- let , and denote ,  as the number of OFDM symbols of the PUSCH in the first and second hop, respectively;

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH;

- ;

- ;

- .

If frequency hopping is not configured for the PUSCH,

- denote  as the OFDM symbol index of the first OFDM symbol after the first set of consecutive OFDM symbol(s) carrying DMRS;

- denote  as the OFDM symbol index of the first OFDM symbol that does not carry DMRS;

- if HARQ-ACK is present for transmission on the PUSCH or if both HARQ-ACK and CG-UCI are present on the same PUSCH with UL-SCH, let ;

- if CSI is present for transmission on the PUSCH, let  and ;

- if CG-UCI is present for transmission on the PUSCH without HARQ-ACK, let ;

- let  and .

The multiplexed data and control coded bit sequence  is obtained according to the following:

**Step 1:**

Set  for ;

Set  for ;

Set  for ;

Set  for ;

if the number of HARQ-ACK information bits to be transmitted on PUSCH is 0, 1 or 2 bits and without CG-UCI:

the number of reserved resource elements for potential HARQ-ACK transmission is calculated according to Clause 6.3.2.4.2.1, by setting ;

denote  as the number of coded bits for potential HARQ-ACK transmission using the reserved resource elements;

if frequency hopping is configured for the PUSCH, let  and ;

if frequency hopping is not configured for the PUSCH, let ;

denote  as the set of reserved resource elements for potential HARQ-ACK transmission, in OFDM symbol , for ;

Set ;

Set ;

 for ;

for  to 

;

while 

if 

if 

;

;

end if

if 

;

;

end if

for  to 



;

end for

end if

;

end while

end for

else

 for ;

end if

Denote  as the number of elements in .

**Step 2:**

if HARQ-ACK is present for transmission on the PUSCH and the number of HARQ-ACK information bits is more than 2 or if both HARQ-ACK and CG-UCI are present on the same PUSCH with UL-SCH:

Set ;

Set ;

Set ;

for  to 

;

while 

if 

if 

;

;

end if

if 

;

;

end if

for  to 

;

for  to 

;

;

;

end for

end for

;

for  to 

;

end for

;

;

;

;

end if

;

end while

end for

end if

**Step 2A:**

If CG-UCI is present for transmission on the PUSCH without HARQ-ACK:

Set ;

Set ;

Set ;

for to

;

while ()

if

if

;

;

end if

if

;

;

end if

for to

;

for to

;

;

;

end for

end for

;

for to

;

end for

;

;

;

;

end if

;

end while

end for

end if

**Step 3:**

if CSI is present for transmission on the PUSCH:

Set ;

Set ;

Set ;

for  to 

;

while 

;

end while

while 

if 

if 

;

;

end if

if 

;

;

end if

;

for  to 

;

for  to 

;

;

;

end for

end for

;

for  to 

;

end for

;

;

;

;

end if

;

end while

end for

Set ;

Set ;

Set ;

for  to 

;

while 

;

end while

while 

if 

if 

;

;

end if

if 

;

;

end if

for  to 

;

for  to 

;

;

;

end for

end for

;

for  to 

;

end for

;

;

;

;

end if

;

end while

end for

end if

**Step 4:**

if UL-SCH is present for transmission on the PUSCH:

Set ;

for  to 

if 

for  to 

;

for  to 

;

;

end for

end for

end if

end for

end if

**Step 5:**

if HARQ-ACK is present for transmission on the PUSCH without CG-UCI and the number of HARQ-ACK information bits is no more than 2:

Set ;

Set ;

Set ;

for  to 

;

while 

if 

if 

;

;

end if

if 

;

;

end if

for  to 

;

for  to 

;

;

;

end for

end for

end if

;

end while

end for

end if

**Step 6:**

Set ;

for  to 

for  to 

;

for  to 

;

;

end for

end for

end for

## 6.3 Uplink control information

### 6.3.1 Uplink control information on PUCCH

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

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

If the UE is configured with a PUCCH-SCell, *uci-MuxWithDiffPrio* is replaced by *uci-MuxWithDiffPrioSecondaryPUCCHgroup* for the secondary PUCCH group in this clause.

#### 6.3.1.1 UCI bit sequence generation

##### 6.3.1.1.1 HARQ-ACK/SR only

If only HARQ-ACK bits are transmitted on a PUCCH, the UCI bit sequence  is determined by setting  for  and , where the HARQ-ACK bit sequence  is given by Clause 9.1 of [5, TS38.213].

If only HARQ-ACK and SR bits are transmitted on a PUCCH, the UCI bit sequence  is determined by setting  for , for , and , where the HARQ-ACK bit sequence  is given by Clause 9.1 of [5, TS 38.213], and the SR bit sequence  is given by Clause 9.2.5.1 of [5, TS 38.213].

##### 6.3.1.1.2 CSI only

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

If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the bitwidth of a CSI field of the CSI sub-report is determined following the procedure in this clause 6.3.1.1.2 by taking configurations in *CSI-ReportSubConfig* when applicable. If *csi-ReportSubConfig* configures a list of CSI-RS resource IDs, for the determination of the bitwidth of a CRI field, the value of is the number of CSI-RS resources configured in the corresponding *csi-ReportSubConfig*.

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 Table 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 Table 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* or *reportQuantity* set to 'cri-RI-CQI' or 1 CSI-RS port is provided in Table 6.3.1.1.2-3.

Table 6.3.1.1.2-3: RI, LI, CQI, and CRI of *codebookType=typeI-SinglePanel*, or  
*reportQuantity* set to 'cri-RI-CQI', or 1 CSI-RS port

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Field** | **Bitwidth** | | | | |
| **1 antenna port** | **2 antenna ports** | **4 antenna ports** | **>4 antenna ports** | |
| **Rank1~4** | **Rank5~8** |
| Rank Indicator when *codebookType=typeI-SinglePanel* | 0 |  |  |  |  |
| Rank Indicator when *reportQuantity* set to 'cri-RI-CQI' | 0 | 1 | 2 | 3 | 3 |
| 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. For higher layer parameter *reportQuantity* set to 'cri-RI-CQI', the values of the rank indicator field are mapped to rank indicator values with increasing order, where '0' is mapped to rank-1.

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 per Resource** | **> 1 antenna ports per Resource** |
| 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 resourceand  
*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 5.2.1.4.2 [6, TS 38.214]. The values of the rank combination indicator field are mapped to allowed rank combinations in the following order: {1,1}, {1,2}, {2,1},{2,2}, where '0' is mapped to the first allowed rank combination. 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 5.2.1.4.2 [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, if the two resource pairs do not share any CSI-RS resource

*- M*1 = *K*1 - 1 and *M*2 = *K*2 - 2, if the two resource pairs share the same CSI-RS resource from the first CSI-RS resource group

*- M*1 = *K*1 - 2 and *M*2 = *K*2 - 1, if the two resource pairs share the same CSI-RS resource from the second CSI-RS resource group

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, differential RSRP, and CapabilityIndex are provided in Table 6.3.1.1.2-6.

Table 6.3.1.1.2-6: CRI, SSBRI, RSRP, and CapabilityIndex

|  |  |
| --- | --- |
| Field | Bitwidth |
| CRI |  |
| SSBRI |  |
| RSRP | 7 |
| Differential RSRP | 4 |
| CapabilityIndex | 2 |

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' or 'ssb-Index-RSRP-Index'.

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

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

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| CRI |  |
| SSBRI |  |
| SINR | 7 |
| Differential SINR | 4 |
| CapabilityIndex | 2 |

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' or 'ssb-Index-SINR-Index'.

If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the mapping order of CSI fields of one CSI sub-report is determined following the procedure in this clause 6.3.1.1.2, by replacing CSI report #n in the following Tables 6.3.1.1.2-7, 6.3.1.1.2-9 and 6.3.1.1.2-10 with CSI sub-report #n, and taking only Tables 6.3.1.1.2-1/2/3/4 for the determination of the bitwidth of a CSI field.

Table 6.3.1.1.2-7: Mapping order of CSI fields of one CSI report,  
*pmi-FormatIndicator=widebandPMI* and *cqi-FormatIndicator=widebandCQI* or *reportQuantity*set to 'cri-RI-CQI' 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 6.3.1.1.2-7A: Mapping order of CSI fields of one CSI report, *pmi-FormatIndicator=widebandPMI*, *cqi-FormatIndicator=widebandCQI, csi-ReportMode= Mode 1* and *numberOfSingleTRP-CSI-Mode1=0*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | CRI as in Tables 6.3.1.1.2-3A, if reported |
| Rank Combination Indicator as in Tables 6.3.1.1.2-3A, if reported |
| Two Layer Indicators as in Table 6.3.1.1.2-3A, 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 and if reported; |
| Zero padding bits , if needed |
| PMI wideband information fields *X1*, 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 |
| PMI wideband information fields *X2*, 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 reported |
| PMI wideband information fields *X1*, from left to right as in Tables 6.3.1.1.2-1 associated with the second resource within the CSI-RS resource pair, if reported |
| PMI wideband information fields *X2*, 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 reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3A, if reported |

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

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

- where R is the reported rank combination;

- For 2 CSI-RS ports, ;

- For more than 2 CSI-RS ports, ;

- if PMI is reported, and ; otherwise,;

- if PMI is reported, and are obtained according to Tables 6.3.1.1.2-1; otherwise, ;

- if PMI is reported, and are obtained according to Tables 6.3.1.1.2-1; otherwise, ;

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

- if LI is reported, and are obtained according to Tables 6.3.1.1.2-3A; otherwise , .

Table 6.3.1.1.2-8: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP or CRI/RSRP/CapabilityIndex or SSBRI/RSRP/CapabilityIndex reporting, or mapping order of CSI fields of one report for inter-cell 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 |
| CapabilityIndex #1 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #2 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #3 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #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 or CRI/SINR/CapabilityIndex or SSBRI/SINR/CapabilityIndex 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 |
| CapabilityIndex #1 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #2 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #3 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #4 as in Table 6.3.1.1.2-6, 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, if reported |
| CRI or SSBRI #2 of 1st resource group as in Table 6.3.1.1.2-6, if reported |
| 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 from; and all remaining resource groups, if reported, follow the same mapping order as the 1st resource group where CRI or SSBRI #1 of all remaining resource groups is reported from the indicated channel measurement resource set. For all reported resource groups, CRI or SSBRI #1 and CRI or SSBRI #2 are reported from different channel measurement resource sets.

Table 6.3.1.1.2-8C: Mapping order of CSI fields of one report for SSBRI/RSRP reporting for L1/L2‑triggered mobility

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | SSBRI #1 as in Table 6.3.1.1.2-6, if reported |
| SSBRI #2 as in Table 6.3.1.1.2-6, if reported |
| … |
| SSBRI # 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 # as in Table 6.3.1.1.2-6, if reported |
| NOTE: *L* is the number of reported cells provided by higher layer parameter *noOfReportedCell* and *M* is the number of reported SSBRI/RSRP pairs per cell and equal to the value provided by higher layer parameter *nrofReportedRSPerCell.* | |

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* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' 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*

|  |  |
| --- | --- |
| 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 and if reported |
| Rank Combination Indicator as in Tables 6.3.1.1.2-3A, if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3A, if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3A, if reported |
| CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 = 1* and if reported;  First CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 = 2* and if reported |
| Rank Indicator associated with CRI as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Rank Indicator associated with the first CRI as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI associated with CRI for the first TB as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Wideband CQI associated with the first CRI for the first TB as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 = 2* and if reported |
| Subband differential CQI associated with CRI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 if reported;  Subband differential CQI associated with the first CRI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Second CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Rank Indicator associated with the second CRI as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI associated with the second CRI for the first TB as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI associated with the second CRI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| NOTE: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0. | |

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 and if reported;  CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported |
| Rank Combination Indicator as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  Rank Indicator as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported;  Zero padding bits , if needed |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  Wideband CQI for the first TB as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported |
| 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 and if reported;  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 and if reported |
| NOTE: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' 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*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Two Layer Indicators as in Table 6.3.1.1.2-3A, 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 and if reported; |
| 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 |
| 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 if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the second resource within the CSI-RS resource pair, if reported |
| 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 if reported |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Layer Indicator as in Table 6.3.1.1.2-3B, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Layer Indicator as in Table 6.3.1.1.2-3B, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| 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 associated with CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  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 associated with the first CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI,* *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Layer Indicator as in Table 6.3.1.1.2-3B, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| 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 associated with the second CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |

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 and if reported |
| 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 and if reported;  Layer Indicator as in Table 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |

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* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' 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*

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 |
| 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 even subbands with increasing order of subband number associated with CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with the first CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 1 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, or codebook index for 2 antenna ports associated with the first CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with the second CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the second CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 |
| 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with the first CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 1 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, or codebook index for 2 antenna ports associated with the first CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with the second CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the second CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |

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

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair and if reported |
| Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with one CSI-RS resource, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI* and reported part 1 is associated with one CSI-RS resource 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, or codebook index for 2 antenna ports associated with one CSI-RS resource 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 reported part 1 is associated with one CSI-RS resource and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with one CSI-RS resource, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI* and reported part 1 is associated with one CSI-RS resource 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 associated with one CSI-RS resource 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 reported part 1 is associated with one CSI-RS resource and if reported |

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

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | Subband differential CQI of CSI sub-report #1 for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #1 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 of CSI sub-report #1 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 of CSI sub-report #2 for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #2 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 of CSI sub-report #2 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 of CSI sub-report # for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report # 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 of CSI sub-report # 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 of CSI sub-report #1 for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #1 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 of CSI sub-report #1 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 |
| Subband differential CQI of CSI sub-report #2 for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #2 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 of for 2 antenna ports CSI sub-report #2 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 |
| … |
| Subband differential CQI of CSI sub-report # for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report # 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 of CSI sub-report # 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* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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 6.3.1.1.2-7/7A/8/8B |
| CSI report #2  as in Table 6.3.1.1.2-7/7A/8/8B |
| … |
| CSI report #n  as in Table 6.3.1.1.2-7/7A/8/8B |
| NOTE: For a CSI report #i containing CSI sub-reports, where , all CSI sub-reports within the CSI report #i are mapped to the corresponding segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| 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 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| … |
| 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 6.3.1.1.2-7/7A/8/8B/9/9A/9B |
| NOTE: For a CSI report #i containing CSI sub-reports, where , either all CSI sub-reports not of two parts or CSI part 1 of all CSI sub-reports of two parts, are mapped to the corresponding segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.1.1.2-10/10A/10B if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/11C if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/11C if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.1.1.2-11/11A/11B/11C if CSI part 2 exists for CSI report #n |
| NOTE: For a CSI report #i containing CSI sub-reports, where :  - CSI part 2 widebands of all CSI sub-reports are mapped to the corresponding segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number;  - CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub‑reports in increasing order of *CSI-ReportSubConfigID*. | |

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].

##### 6.3.1.1.3 HARQ-ACK/SR and CSI

If none of the CSI reports for transmission on a PUCCH is of two parts, the UCI bit sequence  is generated according to the following, where :

- if there is HARQ-ACK for transmission on the PUCCH, the HARQ-ACK bits are mapped to the UCI bit sequence , where  for , the HARQ-ACK bit sequence  is given by Clause 9.1 of [5, TS38.213], and  is number of HARQ-ACK bits; if there is no HARQ-ACK for transmission on the PUCCH, set ;

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

- 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 , where  is the number of CSI bits.

If at least one of the CSI reports for transmission on a PUCCH is of two parts, two UCI bit sequences are generated,  and , according to the following, where  and :

- if there is HARQ-ACK for transmission on the PUCCH, the HARQ-ACK bits are mapped to the UCI bit sequence , where  for , the HARQ-ACK bit sequence  is given by Clause 9.1 of [5, TS38.213], and  is number of HARQ-ACK bits; if there is no HARQ-ACK for transmission on the PUCCH, set ;

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

- 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 , where  is the number of CSI bits in CSI part 1 of all CSI reports;

- 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 , where  is the number of CSI bits in CSI part 2 of all CSI reports. 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.

##### 6.3.1.1.4 UCI with different priority indexes

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

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

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

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

#### 6.3.1.2 Code block segmentation and CRC attachment

The UCI bit sequence from clause 6.3.1.1 is denoted by , where  is the payload size. The procedure in Clause 6.3.1.2.1 applies for  and the procedure in Clause 6.3.1.2.2 applies for .

##### 6.3.1.2.1 UCI encoded by Polar code

If the payload size , code block segmentation and CRC attachment is performed according to Clause 5.2.1. If ( and ) or if , ; otherwise , where  is the rate matching output sequence length as given in Clauses 6.3.1.4.1 and 6.3.1.4.3.

If , the parity bits  in Clause 5.2.1 are computed by setting  to 6 bits and using the generator polynomial  in Clause 5.1, resulting in the sequence  where  is the code block number and  is the number of bits for code block number .

If , the parity bits  in Clause 5.2.1 are computed by setting  to 11 bits and using the generator polynomial  in Clause 5.1, resulting in the sequence  where  is the code block number and  is the number of bits for code block number .

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

If the payload size , CRC bits are not attached.

The output bit sequence is denoted by , where  for  and .

#### 6.3.1.3 Channel coding of UCI

##### 6.3.1.3.1 UCI encoded by Polar code

Information bits are delivered to the channel coding block. They are denoted by  , where  is the code block number, and  is the number of bits in code block number . The total number of code blocks is denoted by  and each code block is individually encoded by the following:

If , the information bits are encoded via Polar coding according to Clause 5.3.1, by setting , , ,  if  and  if , where  is the rate matching output sequence length as given in Clauses 6.3.1.4.1 and 6.3.1.4.3.

If , the information bits are encoded via Polar coding according to Clause 5.3.1, by setting , , , and .

After encoding the bits are denoted by , where  is the number of coded bits in code block number .

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

Information bits are delivered to the channel coding block. They are denoted by , where  is the number of bits.

The information bits are encoded according to Clause 5.3.3.

After encoding the bits are denoted by , where  is the number of coded bits.

#### 6.3.1.4 Rate matching

For PUCCH formats 2/3/4, the total rate matching output sequence length  is given by Table 6.3.1.4-1, where  , , and  are the number of symbols carrying UCI for PUCCH formats 2/3/4 respectively; ,  and are the number of PRBs that are determined by the UE for PUCCH formats 2/3/4 transmission respectively according to Clause 9.2 of [5, TS38.213]; and , , and  are the spreading factors for PUCCH format 2, PUCCH format 3, and PUCCH format 4, respectively.

Table 6.3.1.4-1: Total rate matching output sequence length 

|  |  |  |
| --- | --- | --- |
| *PUCCH format* | *Modulation order* | |
| QPSK | π/2-BPSK |
| PUCCH format 2 |  | N/A |
| PUCCH format 3 |  |  |
| PUCCH format 4 |  |  |

##### 6.3.1.4.1 UCI encoded by Polar code

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

Table 6.3.1.4.1-1: Rate matching output sequence length 

|  |  |  |
| --- | --- | --- |
| UCI(s) for transmission on a PUCCH | UCI for encoding | Value of |
| HARQ-ACK | HARQ-ACK |  |
| HARQ-ACK, SR | HARQ-ACK, SR |  |
| CSI  (CSI not of two parts) | CSI |  |
| HARQ-ACK, CSI  (CSI not of two parts) | HARQ-ACK, CSI |  |
| HARQ-ACK, SR, CSI  (CSI not of two parts) | HARQ-ACK, SR, CSI |  |
| CSI  (CSI of two parts) | CSI part 1 |  |
| CSI part 2 |  |
| HARQ-ACK, CSI  (CSI of two parts) | HARQ-ACK, CSI part 1 |  |
| CSI part 2 |  |
| HARQ-ACK, SR, CSI  (CSI of two parts) | HARQ-ACK, SR, CSI part 1 |  |
| CSI part 2 |  |

Rate matching is performed according to Clause 5.4.1 by setting  and the rate matching output sequence length to , where  is the number of code blocks for UCI determined according to Clause 6.3.1.2.1 and the value of  is given by Table 6.3.1.4.1-1:

-  is the number of bits for HARQ-ACK for transmission on the current PUCCH;

-  is the number of bits for SR for transmission on the current PUCCH;

-  is the number of bits for CSI part 1 for transmission on the current PUCCH;

-  is the number of bits for CSI part 2 for transmission on the current PUCCH;

- if ,  ; otherwise,  is the number of CRC bits determined according to Clause 6.3.1.2.1, where  equals  for "CSI (CSI of two parts)", equals  for "HARQ-ACK, CSI (CSI of two parts)", and equals  for "HARQ-ACK, SR, CSI (CSI of two parts)" respectively in Table 6.3.1.4.1-1;

-  is the configured maximum PUCCH coding rate;

-  is given by Table 6.3.1.4-1.

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

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

The input bit sequence to rate matching is .

The value of  is determined according to Table 6.3.1.4.1-1 by setting .

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

The output bit sequence after rate matching is denoted as .

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

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

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

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

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

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

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

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

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

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

- is given by Table 6.3.1.4-1.

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

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

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

The input bit sequence to rate matching is .

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

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

The output bit sequence after rate matching is denoted as .

#### 6.3.1.5 Code block concatenation

The input bit sequence for the code block concatenation block are the sequences, for  and where  is the number of rate matched bits for the -th code block.

Code block concatenation is performed according to Clause 5.5.

The bits after code block concatenation are denoted by, where  with the values of  and  given in Clauses 6.3.1.4.1 and 6.3.1.4.3. Let  be the total number of coded bits for transmission and . Set  for .

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

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

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

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

Table 6.3.1.6-1: PUCCH DMRS and UCI symbols

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

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

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

Find the smallest such that .

Set ;

Set ;

Set ;

Set ;

for  to 

if 

for  to 

for  to 

;

;

end for

end for

elseif 

if 

;

else

;

end if

;

for  to 

for  to 

;

;

end for

end for

for  to 

for  to 

;

;

end for

end for

else

for  to 

for  to 

;

;

end for

end for

end if

end for

Set 

for  to 

for  to 

for  to 

;

;

end for

end for

end for

### 6.3.2 Uplink control information on PUSCH

The following clauses 6.3.2.2, 6.3.2.3, and 6.3.2.5 apply regardless of whether the higher layer parameter *uci-MuxWithDiffPrio* is configured or not. The following clauses 6.3.2.1, 6.3.2.4, and 6.3.2.6 apply by assuming *uci-MuxWithDiffPrio* is not configured, or *uci-MuxWithDiffPrio* is configured and the UCIs for transmission on a PUSCH are of the same priority index, unless stated otherwise.

If the UE is configured with a PUCCH-SCell, *uci-MuxWithDiffPrio* is replaced by *uci-MuxWithDiffPrioSecondaryPUCCHgroup* for the secondary PUCCH group in this clause*.*

#### 6.3.2.1 UCI bit sequence generation

##### 6.3.2.1.1 HARQ-ACK

If HARQ-ACK bits are transmitted on a PUSCH, the UCI bit sequence  is determined as follows:

- If UCI is transmitted on PUSCH without UL-SCH and the UCI includes CSI part 1 without CSI part 2,

- if there is no HARQ-ACK bit given by Clause 9.1 of [5, TS 38.213], set , , and ;

- if there is only one HARQ-ACK bit  given by Clause 9.1 of [5, TS 38.213], set , , and ;

- otherwise, set  for  and , where the HARQ-ACK bit sequence  is given by Clause 9.1 of [5, TS 38.213].

##### 6.3.2.1.2 CSI

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

If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the bitwidth of a CSI field of the CSI sub-report is determined following the procedure in this clause 6.3.2.1.2 by taking configurations in *CSI-ReportSubConfig* when applicable. If *csi-ReportSubConfig* configures a list of CSI-RS resource IDs, for the determination of the bitwidth of a CRI field, the value of is the number of CSI-RS resources configured in the corresponding *csi-ReportSubConfig*.

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/RI/LI/CQI/CRI with 1 CSI-RS port 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 TS 38.214 [6] is the number of nonzero coefficients for layer such that . | | | | | | | | | | | | | | | | | | |

The bitwidth for PMI of *codebookType=typeII-CJT* is provided in Tables 6.3.2.1.2-1B, where the values of , , , , , , , and are given by Clause 5.2.2.2.8 in [6, TS 38.214].

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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 |
| Rank=2 | 4 | 4 | | N/A | N/A | | N/A | |  |  |
| Rank=3 | 4 | 4 | | 4 | N/A | | N/A | |  |  |
| Rank=4 | 4 | 4 | | 4 | 4 | | N/A | |  |  |
| Rank=1 | 4 | N/A | | N/A | N/A | |  | |  | N/A |
| Rank=2 | 4 | 4 | | N/A | N/A | |  | |  |  |
| Rank=3 | 4 | 4 | | 4 | N/A | |  | |  |  |
| Rank=4 | 4 | 4 | | 4 | 4 | |  | |  |  |
|  | **Information fields** | | | | | | | | | |
|  | | |  |  | |  | |  |  |
| Rank=1 | N/A | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=2 | N/A | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=3 |  | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=4 |  | | |  | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=1 | N/A | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=2 | N/A | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=3 |  | | | N/A | if *Mode1* is configured, NA otherwise | |  | |  |  |
| Rank=4 |  | | |  | if *Mode1* is configured, NA otherwise | |  | |  |  |
| NOTE: the bitwidth for , and shown in Table 6.3.2.1.2-1B 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 5.2.2.2.8 in [6, TS 38.214] is the number of nonzero coefficients for layer such that . | | | | | | | | | | |

The bitwidth for PMI of *codebookType=typeII-Doppler* is provided in Tables 6.3.2.1.2-1C, where the values of , , , , , , *Q* and are given by Clause 5.2.2.2.10 in [6, TS 38.214].

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 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 | |  | |  | | |  | | |  | | |  | | |
|  | Information fields | | | | | | | | | | | | | | | | | | | |
|  | | |  | | | |  | | |  | | |  | | |  | | |  |
| Rank=1 | if and Q=2, NA otherwise | | | NA | | | | NA | | | NA | | |  | | |  | | |  |
| Rank=2 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | NA | | | NA | | |  | | |  | | |  |
| Rank=3 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | if and Q=2, NA otherwise | | | NA | | |  | | |  | | |  |
| Rank=4 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | |  | | |  | | |  |
| Rank=1 | if and Q=2, NA otherwise | | | NA | | | | NA | | | NA | | |  | | |  | | |  |
| Rank=2 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | NA | | | NA | | |  | | |  | | |  |
| Rank=3 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | if and Q=2, NA otherwise | | | NA | | |  | | |  | | |  |
| Rank=4 | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | | | if and Q=2, NA otherwise | | | if and Q=2, NA otherwise | | |  | | |  | | |  |
| NOTE: the bitwidth for , and shown in Table 6.3.2.1.2-1C 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 5.2.2.2.10 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 TS 38.214 [6] 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 5.2.2.2.7 in [6, TS 38.214].

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields | | | | | | | | | | | |
|  | |  | |  | |  | | |  | |  |
| Rank=1 |  | | if *N > M=2*, N/A otherwise | |  | | N/A | | | N/A | | N/A |
| Rank=2 |  | | if *N > M=2*, N/A otherwise | |  | |  | | | N/A | | N/A |
| Rank=3 |  | | if *N > M=2*, N/A otherwise | |  | |  | | |  | | N/A |
| Rank=4 |  | | if *N > M=2*, N/A otherwise | |  | |  | | |  | |  |
|  | Information fields | | | | | | | | | | | |
|  |  | |  | |  | |  |  | |  | |
| Rank=1 | 4 | N/A | | N/A | | N/A | |  |  | | N/A if ;  otherwise | |
| Rank=2 | 4 | 4 | | N/A | | N/A | |  |  | | N/A if ;  otherwise | |
| Rank=3 | 4 | 4 | | 4 | | N/A | |  |  | |  | |
| Rank=4 | 4 | 4 | | 4 | | 4 | |  |  | |  | |
| 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 5.2.2.2.7 in TS 38.214 [6] is the number of nonzero coefficients for layer such that . | | | | | | | | | | | | |

If *csi-ReportSubConfig* is configured, for a corresponding CSI sub-report, the mapping order of CSI fields of one CSI sub-report is determined following the procedure in this clause 6.3.2.1.2, by replacing CSI report #n in the following Tables 6.3.2.1.2-3 and 6.3.2.1.2-4 with CSI sub-report #n, and taking only Tables 6.3.1.1.2-1/2/3/4 for the determination of the bitwidth of a CSI field.

The bitwidth for PMI of *codebookType=typeII-CJT-PortSelection* is provided in Tables 6.3.2.1.2-2C, where the values of ,,, , , and are given by Clause 5.2.2.2.9 in [6, TS 38.214].

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Information fields** | | | | | | | | | | | | |
|  | | |  | |  | | |  | |  | |  |
| Rank=1 |  | | | if *N > M=2*, N/A otherwise | |  | | | N/A | | N/A | | N/A |
| Rank=2 |  | | | if *N > M=2*, N/A otherwise | |  | | |  | | N/A | | N/A |
| Rank=3 |  | | | if *N > M=2*, N/A otherwise | |  | | |  | |  | | N/A |
| Rank=4 |  | | | if *N > M=2*, N/A otherwise | |  | | |  | |  | |  |
|  | **Information fields** | | | | | | | | | | | | |
|  |  |  | |  | |  |  | |  | |  | |
| Rank=1 | 4 | N/A | N/A | | N/A | |  |  | | if *Mode1* is configured, NA otherwise | | N/A if ;  otherwise | |
| Rank=2 | 4 | 4 | N/A | | N/A | |  |  | | if *Mode1* is configured, NA otherwise | | N/A if ;  otherwise | |
| Rank=3 | 4 | 4 | 4 | | N/A | |  |  | | if *Mode1* is configured, NA otherwise | |  | |
| Rank=4 | 4 | 4 | 4 | | 4 | |  |  | | if *Mode1* is configured, NA otherwise | |  | |
| NOTE: the bitwidth for , and shown in Table 6.3.2.1.2-2C 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 5.2.2.2.9 in [6, TS 38.214] is the number of nonzero coefficients for layer such that . | | | | | | | | | | | | | |

The bitwidth for PMI of *codebookType=typeII-Doppler-PortSelection* is provided in Tables 6.3.2.1.2-2D, where the values of ,, , , and are given by Clause 5.2.2.2.11 in [6, TS 38.214].

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Information fields | | | | | | | | | | | |
|  | |  | |  | |  | | |  | |  |
| Rank=1 |  | | if *N > M=2*, N/A otherwise | |  | | N/A | | | N/A | | N/A |
| Rank=2 |  | | if *N > M=2*, N/A otherwise | |  | |  | | | N/A | | N/A |
| Rank=3 |  | | if *N > M=2*, N/A otherwise | |  | |  | | |  | | N/A |
| Rank=4 |  | | if *N > M=2*, N/A otherwise | |  | |  | | |  | |  |
|  | Information fields | | | | | | | | | | | |
|  |  | |  | |  | |  |  | |  | |
| Rank=1 | 4 | N/A | | N/A | | N/A | |  |  | | N/A if ;  otherwise | |
| Rank=2 | 4 | 4 | | N/A | | N/A | |  |  | | N/A if ;  otherwise | |
| Rank=3 | 4 | 4 | | 4 | | N/A | |  |  | |  | |
| Rank=4 | 4 | 4 | | 4 | | 4 | |  |  | |  | |
| NOTE: the bitwidth for , and shown in Table 6.3.2.1.2-2D 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 5.2.2.2.11 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 or CRI/RSRP/CapabilityIndex or SSBRI/RSRP/CapabilityIndex reporting is provided in Table 6.3.1.1.2-8. The mapping order of CSI fields of one report for inter-cell 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 or CRI/SINR/CapabilityIndex or SSBRI/SINR/CapabilityIndex 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 TDCP reporting is provided in Table 6.3.2.1.2-3C. The mapping order of CSI fields of one report for SSBRI/RSRP reporting for L1/L2‑triggered mobility 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, SSBRI/SINR reporting, or TDCP 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 6.3.2.1.2-8/8A/8B/9/9A, if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8/8A/8B/9/9A, 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 6.3.2.1.2-8/8A/8B/9/9A, 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 selected CSI-RS resources by a bitmap with bits, this field is present only if and *restrictedCMR-Selection* is configured to *OFF* |
| Indicator of selected value combination or value combination with bitwidth of , this field is present only if |
| Indicator of the total number of non-zero coefficients summed across all layers as in Tables 6.3.2.1.2-8/8A/8B/9/9A, 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*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 1 | CRI as in Table 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported |
| Rank Combination Indicator as in Table 6.3.1.1.2-3A, if reported |
| Wideband CQI for the first TB as in Table 6.3.1.1.2-3A, if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3A, if reported |
| CRI as in Tables 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 = 1* and if reported;  First CRI as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 = 2* and if reported |
| Rank Indicator associated with CRI as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Rank Indicator associated with the first CRI as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI associated with CRI for the first TB as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Wideband CQI associated with the first CRI for the first TB as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 = 2* and if reported |
| Subband differential CQI associated with CRI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 1 if reported;  Subband differential CQI associated with the first CRI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Second CRI as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Rank Indicator associated with the second CRI as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI associated with the second CRI for the first TB as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI associated with the second CRI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3B, if *numberOfSingleTRP-CSI-Mode1 =* 2 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 6.3.2.1.2-3B: 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 Table 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  CRI as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported |
| Rank Combination Indicator as in Table 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  Rank Indicator as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported;  Zero padding bits , if needed |
| Wideband CQI for the first TB as in Table 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  Wideband CQI for the first TB as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource and if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3A, if associated with one CSI-RS resource pair and if reported;  Subband differential CQI for the first TB with increasing order of subband number as in Table 6.3.1.1.2-3B, if associated with one CSI-RS resource 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 6.3.2.1.2-3C: Mapping order of CSI fields of one CSI report for *reportQuantity*=*tdcp*

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | Amplitude value for the configured delay values as in Table 6.3.2.1.2-10 based on the order from the first configured delay to the last configured delay |
| Phase value for the configured delay values as in Table 6.3.2.1.2-10 based on the order from the first configured delay to the last configured delay, if reported |

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*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2 wideband | Two Layer Indicators as in Table 6.3.1.1.2-3A, 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 and if reported; |
| 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 |
| 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 if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1 associated with the second resource within the CSI-RS resource pair, if reported |
| 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 if reported |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Layer Indicator as in Table 6.3.1.1.2-3B, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Layer Indicator as in Table 6.3.1.1.2-3B, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with the first CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| 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 associated with CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  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 associated with the first CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI,* *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3B, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Layer Indicator as in Table 6.3.1.1.2-3B, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1, if associated with the second CRI in CSI part 1, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| 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 associated with the second CRI in CSI part 1, *pmi-FormatIndicator=* *widebandPMI*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |

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 and if reported |
| 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 and if reported;  Layer Indicator as in Table 6.3.1.1.2-3B, if reported part 1 is associated with one CSI-RS resource and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |
| 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 and if reported |

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 the corresponding function defined in clause 5.2.3 of TS 38.214 [6], 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 the corresponding function defined in clause 5.2.3 of TS 38.214 [6], 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* or *typeII-Doppler-PortSelection*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Table 6.3.2.1.2-2B/2D, if reported |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-2B/2D: highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6], if reported |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-2B/2D lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6], 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*

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 |
| 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 even subbands with increasing order of subband number associated with CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with the first CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 1 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, or codebook index for 2 antenna ports associated with the first CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with the second CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the second CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 |
| 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 1 and if reported;  Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with the first CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 1 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, or codebook index for 2 antenna ports associated with the first CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with the second CRI in CSI part 1, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI*, *numberOfSingleTRP-CSI-Mode1 =* 2 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, or codebook index for 2 antenna ports associated with the second CRI in CSI part 1 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*, *numberOfSingleTRP-CSI-Mode1 =* 2 and if reported |

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

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the first resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair 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, or codebook index for 2 antenna ports associated with the second resource within the CSI-RS resource pair, 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 reported part 1 is associated with one CSI-RS resource pair and if reported |
| Subband differential CQI for the second TB of all even subbands with increasing order of subband number associated with one CSI-RS resource, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI* and reported part 1 is associated with one CSI-RS resource 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, or codebook index for 2 antenna ports associated with one CSI-RS resource 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 reported part 1 is associated with one CSI-RS resource and if reported |
| Subband differential CQI for the second TB of all odd subbands with increasing order of subband number associated with one CSI-RS resource, as in Tables 6.3.1.1.2-3B, if *cqi-FormatIndicator=subbandCQI* and reported part 1 is associated with one CSI-RS resource 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 associated with one CSI-RS resource 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 reported part 1 is associated with one CSI-RS resource and if reported |

Table 6.3.2.1.2-5E: Mapping order of CSI fields of one CSI report, CSI part 2 of  
*codebookType=typeII-CJT*

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Table 6.3.2.1.2-1B, if reported; |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-1B:, , , , and highest priority bits of highest priority bits of and highest priority bits of, in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6] where is equivalent to , if present and if reported; |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-1B lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6] where is equivalent to , if reported; |

Table 6.3.2.1.2-5F: Mapping order of CSI fields of one CSI report, CSI part 2 of  
*codebookType= typeII-Doppler*

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Table 6.3.2.1.2-1C, if reported;  The second time-domain wideband CQI as in Table 6.3.2.1.2-8B, if present and reported |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-1C:, , , , and highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on the corresponding function for or for defined in clause 5.2.3 of TS 38.214 [6], if present and if reported;  The second time-domain subband differential CQI of all even subbands with increasing order of subband number, as in Table 6.3.2.1.2-8B, if present and if reported |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-1C lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on the corresponding function for or for defined in clause 5.2.3 of TS 38.214 [6], if reported;  The second time-domain subband differential CQI of all odd subbands with increasing order of subband number, as in Table 6.3.2.1.2-8B, if present and if reported |

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

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n  CSI part 2, group 0 | PMI fields , from left to right as in Table 6.3.2.1.2-2C, if reported |
| CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-2C: highest priority bits of  highest priority bits of , and highest priority bits of, in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6] where is equivalent to , if present and if reported |
| CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Table 6.3.2.1.2-2C lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on the corresponding function defined in clause 5.2.3 of TS 38.214 [6] where is equivalent to , if reported |

Table 6.3.2.1.2-5H: Mapping order of CSI fields of one CSI report containing CSI sub-report(s), CSI part 2 subband

|  |  |
| --- | --- |
| CSI report #n  Part 2 subband | Subband differential CQI of CSI sub-report #1 for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #1 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 of CSI sub-report #1 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 of CSI sub-report #2 for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #2 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 of CSI sub-report #2 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 of CSI sub-report # for the second TB of all even subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report # 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 of CSI sub-report # 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 of CSI sub-report #1 for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #1 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 of CSI sub-report #1 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 |
| Subband differential CQI of CSI sub-report #2 for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report #2 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 of CSI sub-report #2 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 |
| … |
| Subband differential CQI of CSI sub-report # for the second TB of all odd subbands with increasing order of subband number, as in Tables 6.3.1.1.2-3/4, if *cqi-FormatIndicator=subbandCQI* and if reported |
| PMI subband information fields of CSI sub-report # 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 of CSI sub-report # 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* with value set to '1' are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* with value set to '1' as subband 0.  CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B/8C or Table 6.3.2.1.2-3C |
| CSI part 1 of CSI report #2 as in Table 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B/8C or Table 6.3.2.1.2-3C |
| … |
| CSI part 1 of CSI report #n as in Table 6.3.2.1.2-3/3A/3B or Table 6.3.1.1.2-8/8A/8B/8C or Table 6.3.2.1.2-3C |
| NOTE: For a CSI report #i containing CSI sub-reports, where , CSI part 1 of all CSI sub-reports are mapped to the corresponding segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number. CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 wideband, as in Table 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G, if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 wideband, as in Table 6.3.2.1.2-4/4A/4B,  or CSI part 2 with group 0, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G, if CSI part 2 exists for CSI report #n |
| CSI report #1, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/5H,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G, if CSI part 2 exists for CSI report #1 |
| CSI report #2, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/5H,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G,  if CSI part 2 exists for CSI report #2 |
| … |
| CSI report #n, CSI part 2 subband, as in Table 6.3.2.1.2-5/5C/5D/5H,  or CSI part 2 with group 1 and 2, as in Table 6.3.2.1.2-5A/5B/5E/5F/5G,  if CSI part 2 exists for CSI report #n |
| NOTE: For a CSI report #i containing CSI sub-reports, where ,  - CSI part 2 wideband of all CSI sub-reports are mapped to the corresponding segment of the UCI bit sequence of CSI report #i, from upper part to lower part of the segment, in increasing order of CSI sub-report number;  - CSI sub-report #1, CSI sub-report #2, …, CSI sub-report # correspond to the CSI sub-reports in increasing order of *CSI-ReportSubConfigID*. | |

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. The values of the indicator field are mapped to the allowed values of , according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214], with increasing order, where '0' is mapped to .

The bitwidth for RI/CQI of *codebookType*= *typeII-CJT* is provided in Table 6.3.2.1.2-8A.

Table 6.3.2.1.2-8A: RI and CQI of *codebookType= typeII-CJT*

|  |  |
| --- | --- |
| **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, and all CSI-RS resources if configured, | if max allowed rank is 1;  otherwise |

Where is the number of allowed rank indicator values according to Clause 5.2.2.2.8 TS 38.214 [6], is the maximum of for all configured combinations, where, , and are given by Clause 5.2.2.2.8 in TS 38.214 [6]. 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 values of the indicator field are mapped to the allowed values of , according to Clause 5.2.2.2.8 TS 38.214 [6], with increasing order, where '0' is mapped to .

The bitwidth for RI/CQI of *codebookType*= *typeII-Doppler* is provided in Table 6.3.2.1.2-8B.

Table 6.3.2.1.2-8B: RI and CQI of *codebookType= typeII-Doppler*

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| Rank Indicator |  |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| The second time-domain wide-band CQI | 4 |
| The second time-domain 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 Clause 5.2.2.2.10 TS 38.214 [6],, where , , , and are given by Clause 5.2.2.2.10 in TS 38.214 [6]. 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 values of the indicator field are mapped to the allowed values of , according to Clause 5.2.2.2.10 TS 38.214 [6], with increasing order, where '0' is mapped to .

The bitwidth for RI/CQI of codebookType=typeII-PortSelection-r17 or typeII-Doppler-PortSelection is provided in Table 6.3.2.1.2-9.

Table 6.3.2.1.2-9: RI and CQI of *codebookType=typeII-PortSelection-r17* or  
*typeII-Doppler-PortSelection-r18*

|  |  |
| --- | --- |
| 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 5.2.2.2.7 and Clauses 5.2.2.2.11 [6, TS 38.214],, where , , and are given by Clause 5.2.2.2.7 and Clauses 5.2.2.2.11 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. The values of the indicator field are mapped to the allowed values of , according to Clauses 5.2.2.2.7 and Clauses 5.2.2.2.11 [6, TS 38.214], with increasing order, where '0' is mapped to .

The bitwidth for RI/CQI of *codebookType*=*typeII-CJT-PortSelection* is provided in Table 6.3.2.1.2-9A.

Table 6.3.2.1.2-9A: RI and CQI of codebookType= typeII-CJT-PortSelection

|  |  |
| --- | --- |
| **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, and all CSI-RS resources if configured, | if max allowed rank is 1;  otherwise |

Where is the number of allowed rank indicator values according to Clause 5.2.2.2.9 TS 38.214 [6] is the maximum of for all configured combinations, where , , and are given by Clause 5.2.2.2.9 in TS 38.214 [6], and. 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 values of the indicator field are mapped to the allowed values of , according to Clause 5.2.2.2.9 TS 38.214 [6], with increasing order, where '0' is mapped to .

The bitwidth for *reportQuantity*=*tdcp* is provided in Table 6.3.2.1.2-10.

Table 6.3.2.1.2-10: Amplitude and phase values for *reportQuantity*=*tdcp*

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| Amplitude value | 4 |
| Phase value | 4 |

##### 6.3.2.1.3 CG-UCI

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

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

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

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| HARQ process number | 5 if *nrofHARQ-Processes-v1700* in *ConfiguredGrantConfig* is configured;  4 otherwise. |
| Redundancy version | 2 |
| New data indicator | 1 |
| Channel Occupancy Time (COT) sharing information | if both higher layer parameter *ul-toDL-COT-SharingED-Threshold* and higher layer parameter *cg-COT-SharingList* are configured, or if both higher layer parameter *semiStaticChannelAccessConfigUE* and higher layer parameter *cg-COT-SharingList* are configured, or if higher layer parameter *cg-COT-SharingList* is configured in frequency range 2-2, where *C* is the number of combinations configured in *cg-COT-SharingList;*  1 if higher layer parameter *ul-toDL-COT-SharingED-Threshold* is not configured, and if higher layer parameter *semiStaticChannelAccessConfigUE* is not configured, and if higher layer parameter *cg-COT-SharingOffset* is configured;  0 otherwise.  If a UE indicates COT sharing other than "no sharing" in a CG PUSCH within the UE's initiated COT, the UE should provide consistent COT sharing information in all the subsequent CG PUSCHs, if any, occurring within the same UE's initiated COT such that the same DL starting point and duration are maintained. |

##### 6.3.2.1.3A UTO-UCI

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

- set for and , where is provided by *nrofBitsInUTO-UCI*, and the UTO-UCI bit sequence is given by clause 9.3.1 of [5, TS 38.213].

##### 6.3.2.1.4 HARQ-ACK and CG-UCI/UTO-UCI

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedure in this clause 6.3.2.1.4 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, and replacing "When higher layer parameter *cg-UCI-Multiplexing* is configured" with "When UTO-UCI and HARQ-ACK have the same priority index and are jointly encoded and transmitted on a PUSCH".

When higher layer parameter *cg-UCI-Multiplexing* is configured, the UCI bit sequence is determined as follows, where .

- The CG-UCI bits are mapped to the UCI bit sequence, where for . The CG-UCI bit sequence is given by Table 6.3.2.1.3-1 mapped in the order from upper part to lower part, and is number of CG-UCI bits;

- The HARQ-ACK bits are mapped to the UCI bit sequence , where for . The HARQ-ACK bit sequence is given by Clause 9.1 of [5, TS38.213], and is number of HARQ-ACK bits.

##### 6.3.2.1.5 UCI with different priority indexes

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedure in this clause 6.3.2.1.5 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, and replacing "is given by Table 6.3.2.1.3-1 mapped in the order from upper part to lower part" with "is given by clause 9.3.1 of [5, TS 38.213]".

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

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

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

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

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

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

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

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

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

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

- Set for and if HARQ-ACK bits associated with priority index 1 are transmitted without CG-UCI associated with priority index 1, where the HARQ-ACK bit sequence associated with priority index 1 is given by Clause 9.1 of [5, TS 38.213];

- Set for and if CG-UCI associated with priority index 1 is transmitted without HARQ-ACK bits associated with priority index 1, where the CG-UCI bit sequence associated with priority index 1 is given by Table 6.3.2.1.3-1 mapped in the order from upper part to lower part;

- Set as follows, if both CG-UCI associated with priority index 1 and HARQ-ACK bits associated with priority index 1 are transmitted, where

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

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

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

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

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

- Otherwise,

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

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

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

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

- Set for and if CG-UCI associated with priority index 0 is transmitted without HARQ-ACK bits associated with priority index 0, where the CG-UCI bit sequence associated with priority index 0 is given by Table 6.3.2.1.3-1 mapped in the order from upper part to lower part;

- Set as follows if both CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 are transmitted, where

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

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

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

#### 6.3.2.2 Code block segmentation and CRC attachment

Denote the bits of the payload by , where  is the payload size. The procedure in 6.3.2.2.1 applies for  and the procedure in Clause 6.3.2.2.2 applies for .

##### 6.3.2.2.1 UCI encoded by Polar code

Code block segmentation and CRC attachment is performed according to Clause 6.3.1.2.1.

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

The procedure in Clause 6.3.1.2.2 applies.

#### 6.3.2.3 Channel coding of UCI

##### 6.3.2.3.1 UCI encoded by Polar code

Channel coding is performed according to Clause 6.3.1.3.1, except that the rate matching output sequence length  is given in Clause 6.3.2.4.1.

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

Information bits are delivered to the channel coding block. They are denoted by , where  is the number of bits.

The information bits are encoded according to Clause 5.3.3.

After encoding the bits are denoted by , where  is the number of coded bits.

#### 6.3.2.4 Rate matching

In case where there are more than one UL-SCH transport blocks for the PUSCH transmission, the UCI information is multiplexed only on the UL-SCH transport block with highest *IMCS* value for the initial PUSCH, where *IMCS* is as defined in Clause 6.1.4.1 in [6, TS 38.214]. In case the two transport blocks have the same *IMCS* value for the initial PUSCH, the UCI information is multiplexed with data only on the first transport block. The PUSCH for UCI multiplexing in this Clause refers to the UL-SCH transport block for UCI multiplexing.

##### 6.3.2.4.1 UCI encoded by Polar code

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedures in this clause and the clauses it refers to apply by replacing CG-UCI with UTO-UCI in all the notations and texts, when applicable.

6.3.2.4.1.1 HARQ-ACK

For HARQ-ACK transmission on PUSCH not using repetition type B with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined as follows:



where

-  is the number of HARQ-ACK bits;

- if , ; otherwise  is the number of CRC bits for HARQ-ACK determined according to Clause 6.3.1.2.1;

- ;

-  is the number of code blocks for UL-SCH of the PUSCH transmission;

- if the DCI format scheduling the PUSCH transmission includes a CBGTI field indicating that the UE shall not transmit the -th code block, =0; otherwise,  is the -th code block size for UL-SCH of the PUSCH transmission;

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

-  is configured by higher layer parameter *scaling*;

-  is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission.

For HARQ-ACK transmission on PUSCH not using repetition type B with UL-SCH, and if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined as follows:

where

- is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI;

- is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK transmission and is the total number of OFDM symbols of the PUSCH in the slot, including all OFDM symbols used for DMRS;

- is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK transmission;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For HARQ-ACK transmission on an actual repetition of a PUSCH with repetition Type B with UL-SCH, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined as follows:

where

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission assuming a nominal repetition without segmentation, and is the total number of OFDM symbols in a nominal repetition of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH assuming a nominal repetition without segmentation, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH assuming a nominal repetition without segmentation, where is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission assuming a nominal repetition without segmentation;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the actual repetition of the PUSCH transmission, and is the total number of OFDM symbols in the actual repetition of the PUSCH transmission, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the actual repetition of the PUSCH transmission, ;

- for any OFDM symbol that does not carry DMRS of the actual repetition of the PUSCH transmission, where is the number of subcarriers in OFDM symbol that carries PTRS, in the actual repetition of the PUSCH transmission;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For HARQ-ACK transmission on PUSCH without UL-SCH, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined as follows:



where

-  is the number of HARQ-ACK bits;

- if , ; otherwise  is the number of CRC bits for HARQ-ACK defined according to Clause 6.3.1.2.1;;

- ;

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

-  is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission;

-  is the code rate of the PUSCH, determined according to Clause 6.1.4.1 of [6, TS38.214];

-  is the modulation order of the PUSCH;

-  is configured by higher layer parameter *scaling*.

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

Rate matching is performed according to Clause 5.4.1 by setting  and the rate matching output sequence length to , where

-  is the number of code blocks for UCI determined according to Clause 5.2.1;

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH;

- .

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

6.3.2.4.1.2 CSI part 1

For CSI part 1 transmission on PUSCH not using repetition type B with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for CSI part 1 transmission, denoted as , is determined as follows:

where

-  is the number of bits for CSI part 1;

- if , ; otherwise  is the number of CRC bits for CSI part 1 determined according to Clause 6.3.1.2.1;

- ;

-  is the number of code blocks for UL-SCH of the PUSCH transmission;

- if the DCI format scheduling the PUSCH transmission includes a CBGTI field indicating that the UE shall not transmit the -th code block, =0; otherwise, is the -th code block size for UL-SCH of the PUSCH transmission;

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

- if HARQ-ACK is present for transmission on the same PUSCH with UL-SCH and without CG-UCI, where is the number of coded modulation symbols per layer for HARQ-ACK transmitted on the PUSCH as defined in clause 6.3.2.4.1.1 if number of HARQ-ACK information bits is more than 2, and  if the number of HARQ-ACK information bits is no more than 2 bits, where  is the number of reserved resource elements for potential HARQ-ACK transmission in OFDM symbol , for , in the PUSCH transmission, defined in Clause 6.2.7; or

- if both HARQ-ACK and CG-UCI are present on the same PUSCH with UL-SCH, where is the number of coded modulation symbols per layer for HARQ-ACK and CG-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.1.5; or

- if CG-UCI is present on the same PUSCH with UL-SCH and without HARQ-ACK, where is the number of coded modulation symbols per layer for CG-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.1.4;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

-  is configured by higher layer parameter *scaling*.

For CSI part 1 transmission on PUSCH not using repetition type B with UL-SCH, and if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the number of coded modulation symbols per layer for CSI part 1 transmission, denoted as , is determined as follows:

where

- is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI;

- is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission of TB processing over multiple slots in the slot with the CSI part 1 transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission of TB processing over multiple slots in the slot with the CSI part 1 transmission and is the total number of OFDM symbols of the PUSCH in the slot, including all OFDM symbols used for DMRS;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For CSI part 1 transmission on an actual repetition of a PUSCH with repetition Type B with UL-SCH, the number of coded modulation symbols per layer for CSI part 1 transmission, denoted as , is determined as follows:

where

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission assuming a nominal repetition without segmentation, and is the total number of OFDM symbols in a nominal repetition of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH assuming a nominal repetition without segmentation, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH assuming a nominal repetition without segmentation, where is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission assuming a nominal repetition without segmentation;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the actual repetition of the PUSCH transmission, and is the total number of OFDM symbols in the actual repetition of the PUSCH transmission, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the actual repetition of the PUSCH transmission, ;

- for any OFDM symbol that does not carry DMRS of the actual repetition of the PUSCH transmission, where is the number of subcarriers in OFDM symbol that carries PTRS, in the actual repetition of the PUSCH transmission;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For CSI part 1 transmission on PUSCH without UL-SCH, the number of coded modulation symbols per layer for CSI part 1 transmission, denoted as , is determined as follows:

if there is CSI part 2 to be transmitted on the PUSCH,



else



end if

where

-  is the number of bits for CSI part 1;

- if , ; otherwise  is the number of CRC bits for CSI part 1 determined according to Clause 6.3.1.2.1;

- ;

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

-  is the number of coded modulation symbols per layer for HARQ-ACK transmitted on the PUSCH if number of HARQ-ACK information bits is more than 2, and  if the number of HARQ-ACK information bits is no more than 2 bits, where  is the number of reserved resource elements for potential HARQ-ACK transmission in OFDM symbol , for , in the PUSCH transmission, defined in Clause 6.2.7;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

-  is the code rate of the PUSCH, determined according to Clause 6.1.4.1 of [6, TS38.214];

-  is the modulation order of the PUSCH.

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

Rate matching is performed according to Clause 5.4.1 by setting  and the rate matching output sequence length to , where

-  is the number of code blocks for UCI determined according to Clause 5.2.1;

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH;

- .

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

6.3.2.4.1.3 CSI part 2

For CSI part 2 transmission on PUSCH not using repetition type B with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for CSI part 2 transmission, denoted as , is determined as follows:

where

-  is the number of bits for CSI part 2;

- if , ; otherwise  is the number of CRC bits for CSI part 2 determined according to Clause 6.3.1.2.1;

- ;

-  is the number of code blocks for UL-SCH of the PUSCH transmission;

- if the DCI format scheduling the PUSCH transmission includes a CBGTI field indicating that the UE shall not transmit the -th code block, =0; otherwise, is the -th code block size for UL-SCH of the PUSCH transmission;

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

- if HARQ-ACK is present for transmission on the same PUSCH with UL-SCH and without CG-UCI, where is the number of coded modulation symbols per layer for HARQ-ACK transmitted on the PUSCH as defined in clause 6.3.2.4.1.1 if number of HARQ-ACK information bits is more than 2, and  if the number of HARQ-ACK information bits is 1 or 2 bits; or

- if both HARQ-ACK and CG-UCI are present on the same PUSCH with UL-SCH, where is the number of coded modulation symbols per layer for HARQ-ACK and CG-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.1.5; or

- if CG-UCI is present on the same PUSCH with UL-SCH and without HARQ-ACK, where is the number of coded modulation symbols per layer for CG-UCI transmitted on the PUSCH as defined in clause 6.3.2.4.1.4;

-  is the number of coded modulation symbols per layer for CSI part 1 transmitted on the PUSCH;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, .

-  is configured by higher layer parameter *scaling*.

For CSI part 2 transmission on PUSCH not using repetition type B with UL-SCH, and if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the number of coded modulation symbols per layer for CSI part 2 transmission, denoted as , is determined as follows:

where

- is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI;

- is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission of TB processing over multiple slots in the slot with the CSI part 2 transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission of TB processing over multiple slots in the slot with the CSI part 2 transmission and is the total number of OFDM symbols of the PUSCH in the slot, including all OFDM symbols used for DMRS;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For CSI part 2 transmission on an actual repetition of a PUSCH with repetition Type B with UL-SCH, the number of coded modulation symbols per layer for CSI part 2 transmission, denoted as , is determined as follows:

where

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission assuming a nominal repetition without segmentation, and is the total number of OFDM symbols in a nominal repetition of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH assuming a nominal repetition without segmentation, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH assuming a nominal repetition without segmentation, where is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission assuming a nominal repetition without segmentation;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the actual repetition of the PUSCH transmission, and is the total number of OFDM symbols in the actual repetition of the PUSCH transmission, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the actual repetition of the PUSCH transmission, ;

- for any OFDM symbol that does not carry DMRS of the actual repetition of the PUSCH transmission, where is the number of subcarriers in OFDM symbol that carries PTRS, in the actual repetition of the PUSCH transmission;

- and all the other notations in the formula are defined the same as for PUSCH not using repetition type B and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

For CSI part 2 transmission on PUSCH without UL-SCH, the number of coded modulation symbols per layer for CSI part 2 transmission, denoted as , is determined as follows:



where

-  is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

-  is the number of subcarriers in OFDM symbol  that carries PTRS, in the PUSCH transmission;

-  is the number of coded modulation symbols per layer for HARQ-ACK transmitted on the PUSCH if number of HARQ-ACK information bits is more than 2, and  if the number of HARQ-ACK information bits is 1 or 2 bits;

-  is the number of coded modulation symbols per layer for CSI part 1 transmitted on the PUSCH;

-  is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission and  is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, .

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

Rate matching is performed according to Clause 5.4.1 by setting  and the rate matching output sequence length to , where

-  is the number of code blocks for UCI determined according to Clause 5.2.1;

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH;

- .

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

6.3.2.4.1.4 CG-UCI

For CG-UCI transmission on PUSCH with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for CG-UCI transmission, denoted as , is determined as follows:

where

- is the number of CG-UCI bits;

- is the number of CRC bits for CG-UCI determined according to Clause 6.3.1.2.1;

- ;

- is the number of code blocks for UL-SCH of the PUSCH transmission;

- is the *r*-th code block size for UL-SCH of the PUSCH transmission;

- is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

- is the number of subcarriers in OFDM symbol *l* that carries PTRS, in the PUSCH transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol *l*, for =0,1,2,…, , in the PUSCH transmission and is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

- is configured by higher layer parameter *scaling*;

- is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission.

For CG-UCI transmission on PUSCH with UL-SCH, and if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the number of coded modulation symbols per layer for CG-UCI transmission, denoted as , is determined as follows:

where

- is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI;

- is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission of TB processing over multiple slots in the slot with the CG-UCI transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission of TB processing over multiple slots in the slot with the CG-UCI transmission and is the total number of OFDM symbols of the PUSCH in the slot, including all OFDM symbols used for DMRS;

- is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission of TB processing over multiple slots in the slot with the CG-UCI transmission;

- and all the other notations in the formula are defined the same as for PUSCH with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

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

Rate matching is performed according to Clause 5.4.1 by setting and the rate matching output sequence length to , where

- is the number of code blocks for UCI determined according to Clause 5.2.1;

- is the number of transmission layers of the PUSCH;

- is the modulation order of the PUSCH;

- .

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

6.3.2.4.1.5 HARQ-ACK and CG-UCI

For HARQ-ACK and CG-UCI transmission on PUSCH with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table, or if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is equal to 1, the number of coded modulation symbols per layer for HARQ-ACK and CG-UCI transmission, denoted as , is determined as follows:

where

- is the number of HARQ-ACK bits;

- is the number of CG-UCI bits;

- if , ; otherwise is the number of CRC bits for HARQ-ACK and CG-UCI determined according to Clause 6.3.1.2.1;

- ;

- is the number of code blocks for UL-SCH of the PUSCH transmission;

- is the *r*-th code block size for UL-SCH of the PUSCH transmission;

- is the scheduled bandwidth of the PUSCH transmission, expressed as a number of subcarriers;

- is the number of subcarriers in OFDM symbol *l* that carries PTRS, in the PUSCH transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol *l*, for =0,1,2,…, , in the PUSCH transmission and is the total number of OFDM symbols of the PUSCH, including all OFDM symbols used for DMRS;

- for any OFDM symbol that carries DMRS of the PUSCH, ;

- for any OFDM symbol that does not carry DMRS of the PUSCH, ;

- is configured by higher layer parameter *scaling*;

- is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission.

For HARQ-ACK and CG-UCI transmission on PUSCH with UL-SCH, and if *numberOfSlotsTBoMS* is present in the resource allocation table and the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI is larger than 1, the number of coded modulation symbols per layer for HARQ-ACK and CG-UCI transmission, denoted as , is determined as follows:

where

- is the value of *numberOfSlotsTBoMS* in the row indicated by the Time domain resource assignment field in DCI;

- is the number of subcarriers in OFDM symbol that carries PTRS, in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK and CG-UCI transmission;

- is the number of resource elements that can be used for transmission of UCI in OFDM symbol , for , in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK and CG-UCI transmission and is the total number of OFDM symbols of the PUSCH in the slot, including all OFDM symbols used for DMRS;

- is the symbol index of the first OFDM symbol that does not carry DMRS of the PUSCH, after the first DMRS symbol(s), in the PUSCH transmission of TB processing over multiple slots in the slot with the HARQ-ACK and CG-UCI transmission;

- and all the other notations in the formula are defined the same as for PUSCH with UL-SCH and if *numberOfSlotsTBoMS* is not present in the resource allocation table.

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

Rate matching is performed according to Clause 5.4.1 by setting and the rate matching output sequence length to , where

- is the number of code blocks for UCI determined according to Clause 5.2.1;

- is the number of transmission layers of the PUSCH;

- is the modulation order of the PUSCH;

- .

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

6.3.2.4.1.6 UCI with different priority indexes

In this clause, is equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 1, and equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 0. is equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 0, and equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 1.

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

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

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

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

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

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

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

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

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

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

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.1.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by , if HARQ-ACK bits associated with priority index 1 are transmitted without CG-UCI associated with priority index 1.

- Perform rate matching for CG-UCI with priority index 1 according to clause 6.3.2.4.1.4, if CG-UCI associated with priority index 1 is transmitted without HARQ-ACK bits associated with priority index 1.

- Perform rate matching for CG-UCI with priority index 1 and HARQ-ACK with priority index 1 according to clause 6.3.2.4.1.5, if both CG-UCI associated with priority index 1 and HARQ-ACK bits associated with priority index 1 are transmitted, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

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

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.1.2, by taking HARQ-ACK with priority index 1 if any as HARQ-ACK, and taking CG-UCI associated with priority index 1 if any as CG-UCI.

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

- Otherwise,

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

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

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

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

- Perform rate matching for CG-UCI associated with priority index 0 according to clause 6.3.2.4.1.2, if CG-UCI associated with priority index 0 is transmitted without HARQ-ACK bits associated with priority index 0, by taking CG-UCI associated with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 according to clause 6.3.2.4.1.2, if both CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 are transmitted, by taking CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

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

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

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedures in this clause and the clauses it refers to apply by replacing CG-UCI with UTO-UCI in all the notations and texts.

6.3.2.4.2.1 HARQ-ACK

For HARQ-ACK transmission on PUSCH, the number of coded modulation symbols per layer for HARQ-ACK transmission, denoted as , is determined according to Clause 6.3.2.4.1.1, by setting the number of CRC bits .

The input bit sequence to rate matching is .

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

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH.

The output bit sequence after rate matching is denoted as .

6.3.2.4.2.2 CSI part 1

For CSI part 1 transmission on PUSCH, the number of coded modulation symbols per layer for CSI part 1 transmission, denoted as , is determined according to Clause 6.3.2.4.1.2, by setting the number of CRC bits .

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

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH.

The output bit sequence after rate matching is denoted as .

6.3.2.4.2.3 CSI part 2

For CSI part 2 transmission on PUSCH, the number of coded modulation symbols per layer for CSI part 2 transmission, denoted as , is determined according to Clause 6.3.2.4.1.3, by setting the number of CRC bits .

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

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH.

The output bit sequence after rate matching is denoted as .

6.3.2.4.2.4 CG-UCI

For CG-UCI transmission on PUSCH, the number of coded modulation symbols per layer for CG-UCI transmission, denoted as , is determined according to Clause 6.3.2.4.1.4, by setting the number of CRC bits .

The input bit sequence to rate matching is .

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

, where

- is the number of transmission layers of the PUSCH;

- is the modulation order of the PUSCH.

The output bit sequence after rate matching is denoted as .

6.3.2.4.2.5 HARQ-ACK and CG-UCI

For HARQ-ACK and CG-UCI transmission on PUSCH, the number of coded modulation symbols per layer for HARQ-ACK and CG-UCI transmission, denoted as , is determined according to Clause 6.3.2.4.1.5, by setting the number of CRC bits .

The input bit sequence to rate matching is .

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

- is the number of transmission layers of the PUSCH;

- is the modulation order of the PUSCH.

The output bit sequence after rate matching is denoted as .

6.3.2.4.2.6 UCI with different priority indexes

In this clause, is equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 1, and equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 0. is equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 0, and equal to defined in [5, TS38.213] in case of PUSCH associated with priority index 1.

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

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

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

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

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

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

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

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

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

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

- Perform rate matching for HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.1, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by , if HARQ-ACK bits associated with priority index 1 are transmitted without CG-UCI associated with priority index 1.

- Perform rate matching for CG-UCI with priority index 1 according to clause 6.3.2.4.2.4, if CG-UCI associated with priority index 1 is transmitted without HARQ-ACK bits associated with priority index 1.

- Perform rate matching for CG-UCI with priority index 1 and HARQ-ACK with priority index 1 according to clause 6.3.2.4.2.5, if both CG-UCI associated with priority index 1 and HARQ-ACK bits associated with priority index 1 are transmitted, by taking HARQ-ACK with priority index 1 as HARQ-ACK and replacing by .

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

- Perform rate matching for CSI part 1 according to clause 6.3.2.4.2.2, by taking HARQ-ACK with priority index 1 if any as HARQ-ACK, and taking CG-UCI associated with priority index 1 if any as CG-UCI.

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

- Otherwise,

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

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

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

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

- Perform rate matching for CG-UCI associated with priority index 0 according to clause 6.3.2.4.2.2, if CG-UCI associated with priority index 0 is transmitted without HARQ-ACK bits associated with priority index 0, by taking CG-UCI associated with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

- Perform rate matching for CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 according to clause 6.3.2.4.2.2, if both CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 are transmitted, by taking CG-UCI associated with priority index 0 and HARQ-ACK bits associated with priority index 0 as CSI-part 1 and replacing by and taking HARQ-ACK with priority index 1 as HARQ-ACK.

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

#### 6.3.2.5 Code block concatenation

Code block concatenation is performed according to Clause 6.3.1.5, except that the values of  and  given in Clause 6.3.2.4.1.

#### 6.3.2.6 Multiplexing of coded UCI bits to PUSCH

The coded UCI bits are multiplexed onto PUSCH according to the procedures in Clause 6.2.7.

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

If the higher layer parameter *nrofBitsInUTO-UCI* is configured, the procedure in this clause 6.3.2.7 applies by replacing CG-UCI with UTO-UCI in all the notations and texts, when applicable.

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

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

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

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

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

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

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

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

# 7 Downlink transport channels and control information

## 7.1 Broadcast channel

Data arrives to the coding unit in the form of a maximum of one transport block every 80ms. The following coding steps can be identified:

- Payload generation

- Scrambling

- Transport block CRC attachment

- Channel coding

- Rate matching

### 7.1.1 PBCH payload generation

Denote the bits in a transport block delivered to layer 1 by , where  is the payload size generated by higher layers. The lowest order information bit  is mapped to the most significant bit of the transport block as defined in Clause 6.1.1 of [8, TS 38.321].

Generate the following additional timing related PBCH payload bits , where:

-  are the 4th, 3rd, 2nd, and 1st LSB of SFN, respectively;

-  is the half frame bit ;

- if as defined in Clause 4.1 of [5, TS38.213],

is the MSB of as defined in Clause 7.4.3.1 of [4, TS 38.211].

is reserved.

is the MSB of candidate SS/PBCH block index.

- else if as defined in Clause 4.1 of [5, TS38.213],

is the MSB of as defined in Clause 7.4.3.1 of [4, TS 38.211].

, are the 5th and 4th bits of the candidate SS/PBCH block index, respectively.

- else if as defined in Clause 4.1 of [5, TS38.213],

, , are the 6th, 5th, and 4th bits of the candidate SS/PBCH block index, respectively.

- else

is the MSB of as defined in Clause 7.4.3.1 of [4, TS 38.211].

, are reserved.

- end if

Let ; ; ; ; ;

for  to 

if  is an SFN bit

;

;

elseif  is the half radio frame bit



elseif 

;

;

else

;

;

end if

end for

where is the number of candidate SS/PBCH blocks in a half frame according to Clause 4.1 of [5, TS38.213], and the value of  is given by Table 7.1.1-1.

Table 7.1.1-1: Value of PBCH payload interleaver pattern 

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 16 | 4 | 8 | 8 | 24 | 12 | 3 | 16 | 9 | 20 | 14 | 24 | 21 | 28 | 27 |
| 1 | 23 | 5 | 30 | 9 | 7 | 13 | 2 | 17 | 11 | 21 | 15 | 25 | 22 | 29 | 28 |
| 2 | 18 | 6 | 10 | 10 | 0 | 14 | 1 | 18 | 12 | 22 | 19 | 26 | 25 | 30 | 29 |
| 3 | 17 | 7 | 6 | 11 | 5 | 15 | 4 | 19 | 13 | 23 | 20 | 27 | 26 | 31 | 31 |

### 7.1.2 Scrambling

For PBCH transmission in a frame, the bit sequence  is scrambled into a bit sequence , where  for  and  is generated according to the following:

;

;

while 

if  corresponds to any one of the bits belonging to the candidate SS/PBCH block index, the half frame index, and 2nd and 3rd least significant bits of the system frame number

;

else

;

;

end if

;

end while

The scrambling sequence  is given by Clause 5.2.1of [4, TS38.211] and initialized with  at the start of each SFN satisfying ;  for or , for , for , and  for , where is the number of candidate SS/PBCH blocks in a half frame according to Clause 4.1 of [5, TS38.213]; and  is determined according to Table 7.1.2-1 using the 3rd and 2nd LSB of the SFN in which the PBCH is transmitted.

Table 7.1.2-1: Value of  for PBCH scrambling

|  |  |
| --- | --- |
| *(3rd LSB of SFN, 2nd LSB of SFN)* | *Value of* |
| (0, 0) | 0 |
| (0, 1) | 1 |
| (1, 0) | 2 |
| (1, 1) | 3 |

### 7.1.3 Transport block CRC attachment

Error detection is provided on BCH transport blocks through a Cyclic Redundancy Check (CRC).

The entire transport block is used to calculate the CRC parity bits. The input bit sequence is denoted by , and the parity bits by, where  is the payload size and  is the number of parity bits.

The parity bits are computed and attached to the BCH transport block according to Clause 5.1 by setting  to 24 bits and using the generator polynomial , resulting in the sequence, where .

The bit sequence  is the input bit sequence  to the channel encoder, where  for  and .

### 7.1.4 Channel coding

Information bits are delivered to the channel coding block. They are denoted by  , where  is the number of bits, and they are encoded via Polar coding according to Clause 5.3.1, by setting , , , and .

After encoding the bits are denoted by , where  is the number of coded bits.

### 7.1.5 Rate matching

The input bit sequence to rate matching is .

The rate matching output sequence length .

Rate matching is performed according to Clause 5.4.1 by setting .

The output bit sequence after rate matching is denoted as .

## 7.2 Downlink shared channel and paging channel

### 7.2.1 Transport block CRC attachment

Error detection is provided on each transport block through a Cyclic Redundancy Check (CRC).

The entire transport block is used to calculate the CRC parity bits. Denote the bits in a transport block delivered to layer 1 by, and the parity bits by, where  is the payload size and  is the number of parity bits. The lowest order information bit  is mapped to the most significant bit of the transport block as defined in Clause 6.1.1 of [TS38.321].

The parity bits are computed and attached to the DL-SCH transport block according to Clause 5.1, by setting  to 24 bits and using the generator polynomial  if ; and by setting  to 16 bits and using the generator polynomial  otherwise.

The bits after CRC attachment are denoted by , where .

### 7.2.2 LDPC base graph selection

For initial transmission of a transport block with coding rate  indicated by the MCS index according to Clause 5.1.3.1 in [6, TS 38.214] and subsequent re-transmission of the same transport block, each code block of the transport block is encoded with either LDPC base graph 1 or 2 according to the following:

- if , or if  and , or if , LDPC base graph 2 is used;

- otherwise, LDPC base graph 1 is used,

where  is the payload size in Clause 7.2.1.

### 7.2.3 Code block segmentation and code block CRC attachment

The bits input to the code block segmentation are denoted by  where  is the number of bits in the transport block (including CRC).

Code block segmentation and code block CRC attachment are performed according to Clause 5.2.2.

The bits after code block segmentation are denoted by, where  is the code block number and  is the number of bits for code block number  according to Clause 5.2.2.

### 7.2.4 Channel coding

Code blocks are delivered to the channel coding block. The bits in a code block are denoted by  , where  is the code block number, and  is the number of bits in code block number . The total number of code blocks is denoted by  and each code block is individually LDPC encoded according to Clause 5.3.2.

After encoding the bits are denoted by , where the values of  is given in Clause 5.3.2.

### 7.2.5 Rate matching

Coded bits for each code block, denoted as , are delivered to the rate match block, where  is the code block number, and  is the number of encoded bits in code block number . The total number of code blocks is denoted by  and each code block is individually rate matched according to Clause 5.4.2 by setting .

After rate matching, the bits are denoted by, where is the number of rate matched bits for code block number .

### 7.2.6 Code block concatenation

The input bit sequence for the code block concatenation block are the sequences , for  and where  is the number of rate matched bits for the -th code block.

Code block concatenation is performed according to Clause 5.5.

The bits after code block concatenation are denoted by, where  is the total number of coded bits for transmission.

## 7.3 Downlink control information

A DCI transports downlink control information for one or more cells with one RNTI.

The following coding steps can be identified:

- Information element multiplexing

- CRC attachment

- Channel coding

- Rate matching

### 7.3.1 DCI formats

The DCI formats defined in table 7.3.1-1 are supported.

Table 7.3.1-1: DCI formats

| **DCI format** | **Usage** |
| --- | --- |
| 0\_0 | Scheduling of PUSCH in one cell |
| 0\_1 | Scheduling of one or multiple PUSCH in one cell, or indicating downlink feedback information for configured grant PUSCH (CG-DFI) |
| 0\_2 | Scheduling of PUSCH in one cell |
| 0\_3 | Scheduling of one PUSCH in one cell, or multiple PUSCHs in multiple cells with one PUSCH per cell |
| 1\_0 | Scheduling of PDSCH in one cell |
| 1\_1 | Scheduling of one or multiple PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback |
| 1\_2 | Scheduling of PDSCH in one cell |
| 1\_3 | Scheduling of one PDSCH in one cell, or multiple PDSCHs in multiple cells with one PDSCH per cell |
| 2\_0 | Notifying a group of UEs of the slot format, available RB sets, COT duration and search space set group switching |
| 2\_1 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE may assume no transmission is intended for the UE |
| 2\_2 | Transmission of TPC commands for PUCCH and PUSCH |
| 2\_3 | Transmission of a group of TPC commands for SRS transmissions by one or more UEs |
| 2\_4 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE |
| 2\_5 | Notifying the availability of soft resources as defined in Clause 9.3.1 of [10, TS 38.473] |
| 2\_6 | Notifying the power saving information outside DRX Active Time for one or more UEs |
| 2\_7 | Notifying paging early indication and TRS availability indication for one or more UEs |
| 2\_8 | Notifying the aperiodic beam indication and associated time resources |
| 2\_9 | Activating or de-activating the cell DTX and/or DRX configuration of one or multiple serving cells for one or more UEs, and/or for providing NES-mode indication of the primary cell for one or more UEs |
| 3\_0 | Scheduling of NR sidelink in one cell |
| 3\_1 | Scheduling of LTE sidelink in one cell |
| 3\_2 | Scheduling of NR SL PRS in one cell |
| 4\_0 | Scheduling of PDSCH with CRC scrambled by MCCH-RNTI/G-RNTI for broadcast or by multicast-MCCH-RNTI for multicast in RRC\_INACITIVE state |
| 4\_1 | Scheduling of PDSCH with CRC scrambled by G-RNTI/G-CS-RNTI for multicast in RRC\_CONNECTED state or by G-RNTI for multicast in RRC\_INACITIVE state |
| 4\_2 | Scheduling of PDSCH with CRC scrambled by G-RNTI/G-CS-RNTI for multicast in RRC\_CONNECTED state |

The fields defined in the DCI formats below are mapped to the information bits  to  as follows.

Each field is mapped in the order in which it appears in the description, including the zero-padding bit(s), if any, with the first field mapped to the lowest order information bit  and each successive field mapped to higher order information bits. 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 number of information bits in a DCI format is less than 12 bits, zeros shall be appended to the DCI format until the payload size equals 12.

The size of each DCI format except for DCI format 0\_3/1\_3 is determined by the configuration of the corresponding active bandwidth part of the scheduled cell and shall be adjusted as described in clause 7.3.1.0 if necessary.

For a cell set configured by higher layer parameter *MC-DCI-SetofCellsToAddModList*, the size of DCI format 0\_3/1\_3 is determined as follows and shall be adjusted as described in Clause 7.3.1.0 if necessary:

- If *scheduledCellComboListDCI-0-3* for the cell set is configured, the size of DCI format 0\_3 is determined by the configuration of the corresponding active bandwidth part(s) of the scheduled cells in the entry which results in the largest size among the entries in the higher layer parameter *scheduledCellComboListDCI-0-3*; Otherwise, the size of DCI format 0\_3 is determined by the configuration of the corresponding active bandwidth part(s) of the cells configured by higher layer parameter *scheduledCellListDCI-0-3* for the cell set.

- If *scheduledCellComboListDCI-1-3* for the cell set is configured, the size of DCI format 1\_3 is determined by the configuration of the corresponding active bandwidth part(s) of the scheduled cells in the entry which results in the largest size among the entries in the higher layer parameter *scheduledCellComboListDCI-1-3*; Otherwise, the size of DCI format 1\_3 is determined by the configuration of the corresponding active bandwidth part(s) of the cells configured by higher layer parameter *scheduledCellListDCI-1-3* forthe cell set.

If a UE is configured with *pdsch-HARQ-ACK-CodebookList-r16*, *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookList-r16* in this clause.

If a UE is configured with *pdsch-HARQ-ACK-CodebookListMulticast-r17*, *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookListMulticast-r17* in this clause.

For a cell detected in cell search procedure with synchronization raster defined in Table 5.4.3.1-2 or Table 5.4.3.1-3 of [13, TS 38.101-1], the size of CORESET 0 for the cell in this clause refers to the size of punctured CORESET 0 as defined in clause 7.3.2.2 of [4, TS 38.211] if any.

#### 7.3.1.0 DCI size alignment

If necessary, padding or truncation shall be applied to the DCI formats according to the following steps executed in the order below:

Step 0:

- Determine DCI format 0\_0 monitored in a common search space according to clause 7.3.1.1.1 where  is the size of the initial UL bandwidth part.

- Determine DCI format 1\_0 monitored in a common search space according to clause 7.3.1.2.1 where  is given by

- the size of CORESET 0 if CORESET 0 is configured for the cell; and

- the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.

- If DCI format 0\_0 is monitored in common search space and if the number of information bits in the DCI format 0\_0 prior to padding is less than the payload size of the DCI format 1\_0 monitored in common search space for scheduling the same serving cell, a number of zero padding bits are generated for the DCI format 0\_0 until the payload size equals that of the DCI format 1\_0.

- If DCI format 0\_0 is monitored in common search space and if the number of information bits in the DCI format 0\_0 prior to truncation is larger than the payload size of the DCI format 1\_0 monitored in common search space for scheduling the same serving cell, the bitwidth of the frequency domain resource assignment field in the DCI format 0\_0 is reduced by truncating the first few most significant bits such that the size of DCI format 0\_0 equals the size of the DCI format 1\_0.

Step 1:

- Determine DCI format 0\_0 monitored in a UE-specific search space according to clause 7.3.1.1.1 where  is the size of the active UL bandwidth part.

- Determine DCI format 1\_0 monitored in a UE-specific search space according to clause 7.3.1.2.1 where  is the size of the active DL bandwidth part.

- For a UE configured with *supplementaryUplink* in *ServingCellConfig* in a cell, if PUSCH is configured to be transmitted on both the SUL and the non-SUL of the cell and if the number of information bits in DCI format 0\_0 in UE-specific search space for the SUL is not equal to the number of information bits in DCI format 0\_0 in UE-specific search space for the non-SUL, a number of zero padding bits are generated for the smaller DCI format 0\_0 until the payload size equals that of the larger DCI format 0\_0.

- If DCI format 0\_0 is monitored in UE-specific search space and if the number of information bits in the DCI format 0\_0 prior to padding is less than the payload size of the DCI format 1\_0 monitored in UE-specific search space for scheduling the same serving cell, a number of zero padding bits are generated for the DCI format 0\_0 until the payload size equals that of the DCI format 1\_0.

- If DCI format 1\_0 is monitored in UE-specific search space and if the number of information bits in the DCI format 1\_0 prior to padding is less than the payload size of the DCI format 0\_0 monitored in UE-specific search space for scheduling the same serving cell, zeros shall be appended to the DCI format 1\_0 until the payload size equals that of the DCI format 0\_0

Step 2:

- Determine DCI format 0\_1 monitored in a UE-specific search space according to clause 7.3.1.1.2.

- Determine DCI format 1\_1 monitored in a UE-specific search space according to clause 7.3.1.2.2.

- For a UE configured with *supplementaryUplink* in *ServingCellConfig* in a cell, if PUSCH is configured to be transmitted on both the SUL and the non-SUL of the cell and if the number of information bits in format 0\_1 for the SUL is not equal to the number of information bits in format 0\_1 for the non-SUL, zeros shall be appended to smaller format 0\_1 until the payload size equals that of the larger format 0\_1.

- If the size of DCI format 0\_1 monitored in a UE-specific search space equals that of a DCI format 0\_0/1\_0 monitored in another UE-specific search space, one bit of zero padding shall be appended to DCI format 0\_1.

- If the size of DCI format 1\_1 monitored in a UE-specific search space equals that of a DCI format 0\_0/1\_0 monitored in another UE-specific search space, one bit of zero padding shall be appended to DCI format 1\_1.

Step 2A:

- Determine DCI format 0\_2 monitored in a UE-specific search space according to clause 7.3.1.1.3.

- Determine DCI format 1\_2 monitored in a UE-specific search space according to clause 7.3.1.2.3.

- For a UE configured with *supplementaryUplink* in *ServingCellConfig* in a cell, if PUSCH is configured to be transmitted on both the SUL and the non-SUL of the cell and if the number of information bits in format 0\_2 for the SUL is not equal to the number of information bits in format 0\_2 for the non-SUL, zeros shall be appended to smaller format 0\_2 until the payload size equals that of the larger format 0\_2.

Step 2B:

- If the cell is the serving cell for counting the size of one or both DCI format 0\_3 and DCI format 1\_3 as defined in Clause 10.1 of [5, TS38.213],

- Determine DCI format 0\_3 monitored in a UE-specific search space according to clause 7.3.1.1.4.

- Determine DCI format 1\_3 monitored in a UE-specific search space according to clause 7.3.1.2.4.

Step 3:

- If both of the following conditions are fulfilled the size alignment procedure is complete

- the total number of different DCI sizes configured to monitor is no more than 4 for the cell

- the total number of different DCI sizes with C-RNTI configured to monitor is no more than 3 for the cell

Step 4:

- Otherwise

Step 4A:

- Remove the padding bit (if any) introduced in step 2 above.

- Determine DCI format 1\_0 monitored in a UE-specific search space according to clause 7.3.1.2.1 where  is given by

- the size of CORESET 0 if CORESET 0 is configured for the cell; and

- the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.

- Determine DCI format 0\_0 monitored in a UE-specific search space according to clause 7.3.1.1.1 where  is the size of the initial UL bandwidth part.

- If the number of information bits in the DCI format 0\_0 monitored in a UE-specific search space prior to padding is less than the payload size of the DCI format 1\_0 monitored in UE-specific search space for scheduling the same serving cell, a number of zero padding bits are generated for the DCI format 0\_0 monitored in a UE-specific search space until the payload size equals that of the DCI format 1\_0 monitored in a UE-specific search space.

- If the number of information bits in the DCI format 0\_0 monitored in a UE-specific search space prior to truncation is larger than the payload size of the DCI format 1\_0 monitored in UE-specific search space for scheduling the same serving cell, the bitwidth of the frequency domain resource assignment field in the DCI format 0\_0 is reduced by truncating the first few most significant bits such that the size of DCI format 0\_0 monitored in a UE-specific search space equals the size of the DCI format 1\_0 monitored in a UE-specific search space.

Step 4B:

- If the total number of different DCI sizes configured to monitor is more than 4 for the cell after applying the above steps, or if the total number of different DCI sizes with C-RNTI configured to monitor is more than 3 for the cell after applying the above steps

- If the number of information bits in the DCI format 0\_2 prior to padding is less than the payload size of the DCI format 1\_2 for scheduling the same serving cell, a number of zero padding bits are generated for the DCI format 0\_2 until the payload size equals that of the DCI format 1\_2.

- If the number of information bits in the DCI format 1\_2 prior to padding is less than the payload size of the DCI format 0\_2 for scheduling the same serving cell, zeros shall be appended to the DCI format 1\_2 until the payload size equals that of the DCI format 0\_2.

Step 4C:

- If the total number of different DCI sizes configured to monitor is more than 4 for the cell after applying the above steps, or if the total number of different DCI sizes with C-RNTI configured to monitor is more than 3 for the cell after applying the above steps

- If the number of information bits in the DCI format 0\_1 prior to padding is less than the payload size of the DCI format 1\_1 for scheduling the same serving cell, a number of zero padding bits are generated for the DCI format 0\_1 until the payload size equals that of the DCI format 1\_1.

- If the number of information bits in the DCI format 1\_1 prior to padding is less than the payload size of the DCI format 0\_1 for scheduling the same serving cell, zeros shall be appended to the DCI format 1\_1 until the payload size equals that of the DCI format 0\_1.

Step 4D:

- If the total number of different DCI sizes configured to monitor is more than 4 for the cell after applying the above steps and the cell is the serving cell for counting the size of one or both DCI format 0\_3 and DCI format 1\_3 as defined in Clause 10.1 of [5, TS38.213], or if the total number of different DCI sizes with C-RNTI configured to monitor is more than 3 for the cell after applying the above steps and the cell is the serving cell for counting the size of one or both DCI format 0\_3 and DCI format 1\_3 as defined in Clause 10.1 of [5, TS38.213]

- If the number of information bits in the DCI format 0\_3 prior to padding is less than the payload size of the DCI format 1\_3 for scheduling the same cell set, a number of zero padding bits are generated for the DCI format 0\_3 until the payload size equals that of the DCI format 1\_3.

- If the number of information bits in the DCI format 1\_3 prior to padding is less than the payload size of the DCI format 0\_3 for scheduling the same cell set, zeros shall be appended to the DCI format 1\_3 until the payload size equals that of the DCI format 0\_3.

The UE is not expected to handle a configuration that, after applying the above steps, results in

- the total number of different DCI sizes configured to monitor is more than 4 for the cell; or

- the total number of different DCI sizes with C-RNTI configured to monitor is more than 3 for the cell; or

- the size of DCI format 0\_0 in a UE-specific search space is equal to DCI format 0\_1 in another UE-specific search space; or

- the size of DCI format 1\_0 in a UE-specific search space is equal to DCI format 1\_1 in another UE-specific search space; or

- the size of DCI format 0\_0 in a UE-specific search space is equal to DCI format 0\_2 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 0\_0 and 0\_2 are mapped to the same resource; or

- the size of DCI format 1\_0 in a UE-specific search space is equal to DCI format 1\_2 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 1\_0 and 1\_2 are mapped to the same resource; or

- the size of DCI format 0\_1 in a UE-specific search space is equal to DCI format 0\_2 in the same or another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 0\_1 and 0\_2 are mapped to the same resource; or

- the size of DCI format 1\_1 in a UE-specific search space is equal to DCI format 1\_2 in the same or another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 1\_1 and 1\_2 are mapped to the same resource; or

- the size of DCI format 0\_0 in a UE-specific search space is equal to DCI format 0\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 0\_0 and 0\_3 are mapped to the same resource; or

- the size of DCI format 1\_0 in a UE-specific search space is equal to DCI format 1\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 1\_0 and 1\_3 are mapped to the same resource; or

- the size of DCI format 0\_1 in a UE-specific search space is equal to DCI format 0\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 0\_1 and 0\_3 are mapped to the same resource; or

- the size of DCI format 1\_1 in a UE-specific search space is equal to DCI format 1\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 1\_1 and 1\_3 are mapped to the same resource.

- the size of DCI format 0\_2 in a UE-specific search space is equal to DCI format 0\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 0\_2 and 0\_3 are mapped to the same resource; or

- the size of DCI format 1\_2 in a UE-specific search space is equal to DCI format 1\_3 in another UE-specific search space when at least one pair of the corresponding PDCCH candidates of DCI formats 1\_2 and 1\_3 are mapped to the same resource.

##### 7.3.1.0.1 DCI size alignment for DCI formats for scheduling of sidelink

If DCI format 3\_0, and/or DCI format 3\_1, and/or DCI format 3\_2 is monitored on a cell, DCI size alignment for DCI format 3\_0, DCI format 3\_1, and DCI format 3\_2 is performed as described in this clause after performing the DCI size alignment described in Clause 7.3.1.0. The size(s) of the DCI formats configured to monitor for a cell in this clause refers to that after performing the DCI size alignment described in Clause 7.3.1.0.

If DCI format 3\_0, and/or DCI format 3\_1, and/or DCI format 3\_2 is monitored on a cell and the total number of DCI sizes of the DCI formats configured to monitor for the cell and DCI format 3\_0, and/or DCI format 3\_1, and/or DCI format 3\_2 is more than 4, zeros shall be appended to DCI format 3\_0 if configured, to DCI format 3\_1 if configured, and to DCI format 3\_2 if configured, until the payload size of DCI format 3\_0, DCI format 3\_1, and DCI format 3\_2 equals that of the smallest DCI format configured to monitor for the cell that is larger than DCI format 3\_0, DCI format 3\_1, and DCI format 3\_2.

The UE is not expected to handle a configuration that results in:

- the total number of different DCI sizes configured to monitor for the cell and DCI format 3\_0, and/or DCI format 3\_1, and/or DCI format 3\_2 is more than 4; and

- the payload size of DCI format 3\_0, and/or DCI format 3\_1, and/or DCI format 3\_2 is larger than the payload size of all other DCI formats configured to monitor for the cell.

#### 7.3.1.1 DCI formats for scheduling of PUSCH

##### 7.3.1.1.1 Format 0\_0

DCI format 0\_0 is used for the scheduling of PUSCH in one cell.

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by C-RNTI or CS-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

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

-  bits if neither of the higher layer parameters *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, where  is defined in clause 7.3.1.0

- 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 any of the higher layer parameters *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* and *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.

- 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.

If the DCI format 0\_0 is monitored in a UE-specific search space, 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]. If the DCI 0\_0 is monitored in a common search space Y = 0.

- Time domain resource assignment - 4 bits as defined in Clause 6.1.2.1 of [6, TS 38.214]

- Frequency hopping flag - 1 bit according to Table 7.3.1.1.1-3, 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 - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits

- TPC command for scheduled PUSCH - 2 bits as defined in Clause 7.1.1 of [5, TS 38.213]

- ChannelAccess-CPext - 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1; 2 bits indicating channel access type as defined in Table 7.3.1.1.1-4B if *ChannelAccessMode2-r17* is provided for operation in a cell in frequency range 2-2; 0 bit otherwise.

- Padding bits, if required.

- UL/SUL indicator - 1 bit for UEs configured with *supplementaryUplink* in *ServingCellConfig* in the cell as defined in Table 7.3.1.1.1-1 and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).

- If the UL/SUL indicator is present in DCI format 0\_0 and the higher layer parameter *pusch-Config* is not configured on both UL and SUL the UE ignores the UL/SUL indicator field in DCI format 0\_0, and the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured;

- If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the UL or SUL for which high layer parameter *pucch-Config* is configured.

- If the UL/SUL indicator is not present in DCI format 0\_0 and *pucch-Config* is not configured, the corresponding PUSCH scheduled by the DCI format 0\_0 is for the uplink on which the latest PRACH is transmitted.

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by TC-RNTI:

- Identifier for DCI formats - 1 bit

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

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

- bits if the higher layer parameter *useInterlacePUCCH-PUSCH* in *BWP-UplinkCommon* is not configured, where

-  is the size of the initial UL bandwidth part.

- For PUSCH hopping with resource allocation type 1:

-  MSB bits are used to indicate the frequency offset according to Table 8.3-1 in Clause 8.3 of [5, TS 38.213], where  if  and  otherwise

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

- 5 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

- 6 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

- Time domain resource assignment - 4 bits as defined in Clause 6.1.2.1 of [6, TS 38.214]

- Frequency hopping flag - 1 bit according to Table 7.3.1.1.1-3, as defined in Clause 6.3 of [6, TS 38.214]

- Modulation and coding scheme - 5 bits

- If the UE requests repetition of PUSCH scheduled by RAR UL grant [8, TS 38.321], 5 bits as defined in Clause 6.1.2.1 and Clause 6.1.4.1 of [6, TS 38.214];

- otherwise 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214].

- New data indicator - 1 bit, reserved

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits, reserved

- TPC command for scheduled PUSCH - 2 bits as defined in Clause 7.1.1 of [5, TS 38.213]

- ChannelAccess-CPext - 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1; 2 bits indicating channel access type as defined in Table 7.3.1.1.1-4B if *ChannelAccessMode2-r17* is provided for operation in a cell in frequency range 2-2; 0 bit otherwise

- Padding bits, if required.

- UL/SUL indicator - 1 bit if the cell has two ULs and the number of bits for DCI format 1\_0 before padding is larger than the number of bits for DCI format 0\_0 before padding; 0 bit otherwise. The UL/SUL indicator, if present, locates in the last bit position of DCI format 0\_0, after the padding bit(s).

- If 1 bit, reserved, and the corresponding PUSCH is always on the same UL carrier as the previous transmission of the same TB

Table 7.3.1.1.1-1: UL/SUL indicator

|  |  |
| --- | --- |
| Value of UL/SUL indicator | Uplink |
| 0 | The non-supplementary uplink |
| 1 | The supplementary uplink |

Table 7.3.1.1.1-2: Redundancy version

|  |  |
| --- | --- |
| Value of the Redundancy version field | Value of  to be applied |
| 00 | 0 |
| 01 | 1 |
| 10 | 2 |
| 11 | 3 |

Table 7.3.1.1.1-3: Frequency hopping indication

|  |  |
| --- | --- |
| **Bit field mapped to index** | **PUSCH frequency hopping** |
| 0 | Disabled |
| 1 | Enabled |

Table 7.3.1.1.1-4: Channel access type & CP extension for DCI format 0\_0 and  
DCI format 1\_0 for frequency range 1

|  |  |  |
| --- | --- | --- |
| Bit field mapped to index | Channel Access Type | The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211] |
| 0 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 |
| 1 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 |
| 2 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 |
| 3 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Bit field mapped to index** | **Channel Access Type** | **The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211]** | **Initiator of the channel occupancy associated with the UL transmission as described in Clause 4.3.1 in TS 37.213** |
| 0 | No sensing as defined in Clause 4.3 in TS 37.213 [14] | 0 | gNB |
| 1 | No sensing as defined in Clause 4.3 in TS 37.213 [14] | 2 | gNB |
| 2 | Sensing within a 25us interval as defined in Clause 4.3 in TS 37.213 [14] | 0 | gNB |
| 3 | Sensing as defined in Clause 4.3.1.2 in TS 37.213 [14] | 0 | UE |
| NOTE: Row index 3 is only applicable if *semiStaticChannelAccessConfigUE* is provided. Otherwise, the row is reserved. | | | |

Table 7.3.1.1.1-4B: Channel access type for DCI format 0\_0 and  
DCI format 1\_0 for frequency range 2-2

|  |  |
| --- | --- |
| Bit field mapped to index | Channel Access Type |
| 0 | Type 1 channel access defined in clause 4.4.1 of TS 37.213 [14] |
| 1 | Type 2 channel access defined in clause 4.4.2 of TS 37.213 [14] |
| 2 | Type 3 channel access defined in clause 4.4.3 of TS 37.213 [14] |
| 3 | Reserved |

##### 7.3.1.1.2 Format 0\_1

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

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

- Identifier for DCI formats - 1 bit

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

- Carrier indicator - 0 or 3 bits, as defined in Clause 10.1 of [5, TS38.213]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

- DFI flag - 0 or 1 bit

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

- 0 bit otherwise;

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

- HARQ-ACK bitmap - 16 bits if *nrofHARQ-Processes-v1700* in *ConfiguredGrantConfig* is not configured or 32 bits if *nrofHARQ-Processes-v1700* in *ConfiguredGrantConfig* is configured, where the order of the bitmap to HARQ process index mapping is such that HARQ process indices are mapped in ascending order from MSB to LSB of the bitmap. For each bit of the bitmap, value 1 indicates ACK, and value 0 indicates NACK.

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

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

Otherwise, all the remaining fields are set as follows:

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

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

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

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

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

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

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

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

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

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

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

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

- For PUSCH hopping with resource allocation type 1:

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

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

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

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

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

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

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

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

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

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

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

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

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

- Frequency hopping flag - 0 or 1 bit:

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

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

For transport block 1:

- 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.

For transport block 2 (only present if *maxRank-n8* is configured or *maxMIMO-Layers-n8* is configured):

- 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 - 2 bits as defined in Table 7.3.1.1.1-2

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part, *maxRank-n8* is configured or the value of *maxMIMO-Layers* for the indicated bandwidth part is larger than 4 and the value of *maxRank* or *maxMIMO-Layers* for the active bandwidth part is no more than 4, the UE assumes zeros are padded when interpreting the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields for transport block 2 according to Clause 12 of [5, TS38.213], and the UE ignores the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields of transport block 2 for the indicated bandwidth part.

- Transform precoder indicator - 0 or 1 bit

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

- 0 bit otherwise.

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

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

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

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

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

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

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

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

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

- 0 bit otherwise.

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

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

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

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

- 0 bit otherwise.

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

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

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

- SRS resource set indicator - 0 or 2 bits

- 2 bits according to Table 7.3.1.1.2-36 if

- *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with the *usage* of value '*nonCodeBook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided, or

- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with *usage* of value '*codebook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided;

- 0 bit otherwise.

- SRS resource indicator -number of bits determined by the following:

-  bits according to Tables 7.3.1.1.2-28/28A/29/29B/30/30B/31/31B/31C/31D/31E/31F 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,

- is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*,

- 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 max{*maxMIMO-Layers*, *maxMIMO-LayersforSdm*} if *maxMIMO-LayersforSdm* is configured

- Lmax is given by max{*maxMIMO-Layers*, *maxMIMO-LayersforSfn*} if *maxMIMO-LayersforSfn* is configured

- Lmax is given by *maxMIMO-Layers* otherwise

- 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,

- is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*,

- 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*'.

When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the first SRS resource set is associated with *coresetPoolIndex* value 0 and the second SRS resource set is associated with *coresetPoolIndex* value 1, where the first and the second SRS resource sets are respectively the ones with lower and higher *srs-ResourceSetId* of the two SRS resources sets.

- Second SRS resource indicator - number of bits determined by the following:

- 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*, the higher layer paramtere *maxMIMO-LayersforSdm* is not configured, and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set, and

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

- Lmax is given by maxMIMO-LayersforSfn if maxMIMO-LayersforSfn is configured

- Lmax is given by maxMIMO-Layers otherwise

- 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 7.3.1.1.2-28/29 if the higher layer parameter *txConfig = nonCodebook*, the higher layer paramtere *maxMIMO-LayersforSdm* is configured and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set, and *Lmax* is given by *maxMIMO-LayersforSdm.*

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

- 0 bit otherwise.

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

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

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

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} = 2 if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} = 2 if *multipanelScheme =* *sdmScheme,* 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 *maxRank=1* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} = 1 if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} = 1 if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} = 1 if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} = 1 if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} = 2 if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*} = 2 if *multipanelScheme =* *sdmScheme*, 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 *maxRank=1* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*}*=1* if *multipanelScheme =* *sfnScheme* or max{*maxRank*, *maxRankSdm*}*=1* if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRank*, *maxRankSfn*} = 1 if multipanelScheme = sfnScheme or max{*maxRank*, *maxRankSdm*} = 1 if *multipanelScheme* = *sdmScheme*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter codebookSubset;

- 7 bits according to Table 7.3.1.1.2-5B for 8 antenna ports, if *CodebookTypeUL=Codebook1*, transform precoder is disabled, *maxRank-n8* = 8, and according to *ULcodebookFC-N1N2*;

- 7 bits according to Table 7.3.1.1.2-5C for 8 antenna ports, if *CodebookTypeUL=Codebook1*, transform precoder is disabled, *maxRank-n8* =7, and according to *ULcodebookFC-N1N2*;

- 7 bits according to Table 7.3.1.1.2-5D for 8 antenna ports, if *CodebookTypeUL=Codebook1*, transform precoder is disabled, *maxRank-n8* =4, 5 or 6, and according to *maxRank-n8*;

- 4, 6 or 7 bits according to Table 7.3.1.1.2-5E for 8 antenna ports, if *CodebookTypeUL=Codebook1*, transform precoder is enabled or *maxRank* =1, 2 or 3 if transform precoder is disabled, and according to transform precoder and *maxRank*;

- 8 bits according to Table 7.3.1.1.2-5F for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is disabled, *maxRank-n8*=5, 6, 7 or 8, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to *maxRank-n8*;

- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5G for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is disabled, *maxRank*=2, 3 or 4, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to *maxRank*;

- 3 bits according to Table 7.3.1.1.2-5H for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is enabled or *maxRank*=1 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*.

- 10 bits according to Table 7.3.1.1.2-5I for 8 antenna ports, if *CodebookTypeUL=Codebook2*, transform precoder is disabled, *maxRank-n8*=5, 6, 7 or 8, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to *maxRank-n8*;

- 5, 9 or 10 bits according to Table 7.3.1.1.2-5J for 8 antenna ports, if *CodebookTypeUL=Codebook2*, transform precoder is enabled or *maxRank* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to transform precoder and *maxRank*;

- 10 bits according to Table 7.3.1.1.2-5K for 8 antenna ports, if *CodebookTypeUL=Codebook3*, transform precoder is disabled, *maxRank-n8*=5, 6, 7 or 8, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to *maxRank-n8*;

- 4, 7, 9 or 10 bits according to Table 7.3.1.1.2-5L for 8 antenna ports, if *CodebookTypeUL=Codebook3*, transform precoder is enabled or *maxRank* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to transform precoder and *maxRank*;

- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5M for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is disabled, *maxRank*=2, 3 or 4, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to *maxRank*;

- 4 bits according to Table 7.3.1.1.2-5N for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is enabled or *maxRank*=1 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*.

- 6, 9 or 10 bits according to Table 7.3.1.1.2-5O for 8 antenna ports, if *CodebookTypeUL=Codebook2*, transform precoder is enabled or *maxRank* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to transform precoder and *maxRank*;

- 5, 7, 9 or 10 bits according to Table 7.3.1.1.2-5P for 8 antenna ports, if *CodebookTypeUL=Codebook3*, transform precoder is enabled or *maxRank* =1, 2, 3, or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to transform precoder and *maxRank*;

- 8 or 9 bits according to Table 7.3.1.1.2-5Q for 8 antenna ports, if *CodebookTypeUL*=*Codebook4*, transform precoder is disabled, *maxRank-n8*=5, 6, 7 or 8, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to *maxRank-n8*;

- 10 bits according to Table 7.3.1.1.2-5R for 8 antenna ports, if *CodebookTypeUL*=*Codebook2*, transform precoder is disabled, *maxRank-n8*=5, 6, 7 or 8, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to *maxRank-n8*;

- 10 bits according to Table 7.3.1.1.2-5S for 8 antenna ports, if *CodebookTypeUL*=*Codebook3*, transform precoder is disabled, *maxRank-n8* =5, 6, 7, or 8, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to *maxRank-n8*;

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 or 8 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 *ul-FullPowerTransmission* is configured to *fullpowerMode2*, *maxRank* is configured to be larger than 4, and at least one SRS resource with 8 antenna ports is configured in the SRS resource set with usage set to 'codebook', and an SRS resource with 4 antenna ports is indicated via SRI in the same SRS resource set, then Table 7.3.1.1.2-2 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.

When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the Precoding information and number of layers field is associated with the SRS resource set that is associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1.

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

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

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

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

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

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

- 3 or 4 bits according to Table 7.3.1.1.2-2D with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission = fullpowerMode1, maxRank=2* if *multipanelScheme* is not configured or *maxRankSfn=2* if *multipanelScheme =* *sfnScheme,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

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

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* if *multipanelScheme* is not configured or *maxRankSfn* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfn=1* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfn* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfn=2* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfn* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfn=1* if *multipanelScheme =* *sfnScheme*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

- 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 *maxRankSdm* if *multipanelScheme =* *sdmScheme*, 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, maxRankSdm = 2* if *multipanelScheme =* *sdmScheme,* 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 *maxRankSdm* if *multipanelScheme =* *sdmScheme*, 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*, *maxRankSdm = 1* if *multipanelScheme =* *sdmScheme*, 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 *maxRankSdm* if *multipanelScheme =* *sdmScheme*, 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, *maxRankSdm = 2* if *multipanelScheme =* *sdmScheme*, 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 *maxRankSdm= 1* if *multipanelScheme =* *sdmScheme*, and *codebookSubset*;

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

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

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

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

- Antenna ports - number of bits determined by the following

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

- 2 bits as defined by Tables 7.3.1.1.2-6A, if transform precoder is enabled and *dmrs-UplinkTransformPrecoding* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=1, where nSCID is the scrambling identity for antenna ports defined in Clause 6.4.1.1.1.2, TS 38.211 [4];

- 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, TS 38.211 [4];

- 3 bits as defined by Tables 7.3.1.1.2-8/9/10/10A/11 according to the value of rank, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, and *maxLength*=1;

- 4 bits as defined by Tables 7.3.1.1.2-12/13/14/14A/15/15A/15B/15C/15D according to the value of rank, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, and *maxLength*=2;

- 4 bits as defined by Tables 7.3.1.1.2-16/17/18/18A/19/19A/19B according to the value of rank, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, and *maxLength*=1;

- 5 bits as defined by Tables 7.3.1.1.2-20/21/22/22A/23/23A/23B/23C/23D according to the value of rank, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, and *maxLength*=2.

- 4 bits as defined by Tables 7.3.1.1.2-38/39/40/40A/41/42/43/44/45, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is configured, and *maxLength*=1;

- 5 bits as defined by Tables 7.3.1.1.2-46/47/48/48A/49/50/51/52/53, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is configured, and *maxLength*=2;

- 5 bits as defined by Tables 7.3.1.1.2-54/55/56/56A/57/58/59/60/61, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is configured, and *maxLength*=1;

- 6 bits as defined by Tables 7.3.1.1.2-62/63/64/64A/65/66/67/68/69, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is configured, and *maxLength*=2.

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, and the value of rank is:

- the sum of the value determined according to the SRS resource indicator field and the value determined according to the second SRS resource indicator field, if *txConfig = nonCodebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "10"

- the sum of the value determined according to the Precoding information and number of layers field and the value determined according to the Second Precoding information, if *txConfig = codebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "10"

- determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and *multipanelScheme =* *sdmScheme* is not configured, or if the higher layer parameter *txConfig = nonCodebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "00" or “01”,

- determined according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook* and *multipanelScheme =* *sdmScheme* is not configured, or if the higher layer parameter *txConfig = codebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "00" or "01".

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

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

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

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

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

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

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

- CBG transmission information (CBGTI) - 0 bit if higher layer parameter *codeBlockGroupTransmission* for PUSCH is not configured or if the number of scheduled PUSCH indicated by the Time domain resource assignment field is larger than 1; otherwise, 2, 4, 6, or 8 bits as defined in Clause 6.1.5 of [6, TS38.214], determined by higher layer parameter *maxCodeBlockGroupsPerTransportBlock* and *maxRank* or *maxMIMO-Layers* 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* and *multipanelScheme* is not configured, or if *maxRank=1* and *maxRankSfn=1*, or if *maxRank=1* and *maxRankSdm=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;

- 2 or 4 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26/7.3.1.1.2-26A are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.

- 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and *maxRank*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.

- 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRank=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.

- 2 bits when one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and "11", *maxRank=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

- 2 bits when two PTRS ports are configured by *maxNrofPortsforSDM* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and *multipanelScheme* is configured to *sdmScheme*, the MSB of this field indicates the association between PTRS port 0 and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port 1 and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

- 2 bits when one PTRS port is configured by *maxNrofPortsforSDM* in *PTRS-UplinkConfig*, SRS resource set indicator field is present and equals "10" and *multipanelScheme* is configured to *sdmScheme*, this field indicates the association between PTRS port and DMRS ports corresponding to SRS resource indicator field and Second SRS resource indicator field and/or Precoding information and number of layers field and Second Precoding information field according to Table 7.3.1.1.2-25.

- 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig,* SRS resource set indicator field is present and equals "10", *multipanelScheme* is configured to *sfnScheme*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.

- 2 bits when one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is absent, *maxRank>4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port and DMRS port(s) corresponding to the selected codeword according to Table 7.3.1.1.2-25B, where the selected codeword is the codeword with higher MCS for the initial PUSCH if the MCS indices of the two codewords are different for the initial PUSCH, or codeword 0 otherwise.

- 4 bits when two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is absent, *maxRank>4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-26A.

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

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

- Second PTRS-DMRS association - 2 bits if PTRS-DMRS association field and SRS resource set indicator field are present and *maxRank>2* and *multipanelScheme* is not configured; 0 bit otherwise. Tables 7.3.1.1.2-25 and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second precoding information field when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field.

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

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

- DMRS sequence initialization – 0 bit if transform precoder is enabled by higher layers and the Transform precoder indicator field is not present; 1 bit if transform precoder is disabled by higher layers or if the Transform precoder indicator field is present. If the Transform precoder indicator field is present and set to '0', the bit is reserved.

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

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

- 1 bit otherwise. A value of "1" indicates UL-SCH shall be transmitted on the PUSCH and a value of "0" indicates UL-SCH shall not be transmitted on the PUSCH. If a UE does not support triggering SRS only in DCI, except for DCI format 0\_1 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_1 with UL-SCH indicator of "0" and CSI request of all zero(s). If a UE supports triggering SRS only in DCI, except for DCI format 0\_1 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_1 with UL-SCH indicator of "0", CSI request of all zero(s) and SRS request of all zero(s). The UE is not expected to receive a DCI format 0\_1 with UL-SCH indicator of "0", when the indicated number of layers is larger than 4.

- ChannelAccess-CPext-CAPC - 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1, or for operation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

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

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

- 1 or 2 bits otherwise,

- 1 bit if SRS resource indicator is present in the DCI format 0\_1;

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

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

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

- Minimum applicable scheduling offset indicator - 0 or 1 bit

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

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

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

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

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

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

- 0 bit otherwise.

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

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

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

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

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

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

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

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

- 0 bit, otherwise

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

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

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

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

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

Table 7.3.1.1.2-1: Bandwidth part indicator

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

Table 7.3.1.1.2-2: Precoding information and number of layers or Second Precoding information, for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2 or 3 or 4 or max{*maxRank*, *maxRankSfn*} = 2 or 3 or 4 or max{*maxRank*, *maxRankSdm*} = 2 or 3 or 4 or *maxRankSdm*= 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* = *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 or Second Precoding information,, if transform precoder is disabled, *maxRank* = 2 or max{*maxRank*, *maxRankSfn*} = 2 or max{*maxRank*, *maxRankSdm*} = 2 or *maxRankSdm*= 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 or *maxRankSfn* = 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* = *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 or *maxRankSfn* = 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 |
| … | … | … | … |
| 14 | 1 layer: TPMI=14 | 3 | 1 layer: TPMI=3 |
| 15 | 1 layer: TPMI=15 | 4 | 1 layer: TPMI=13 |
| 0 | 2 layers: TPMI=0 | 5-7 | 1 layer: reserved |
| … | … | 0 | 2 layers: TPMI=0 |
| 13 | 2 layers: TPMI=13 | … | … |
| 14-15 | 2 layers: reserved | 6 | 2 layers: TPMI=6 |
|  |  | 7 | 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 |
| … | … | … | … |
| 14 | 1 layer: TPMI=14 | 3 | 1 layer: TPMI=3 |
| 15 | 1 layer: TPMI=15 | 4 | 1 layer: TPMI=13 |
| 0 | 2 layers: TPMI=0 | 5-7 | 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 | 2 layers: reserved |
| … | … | 0 | 3 layers: TPMI=0 |
| 2 | 3 layers: TPMI=2 | 1 | 3 layer: TPMI=1 |
| 3-15 | 3 layers: reserved | 2-7 | 3 layers: reserved |
| 0 | 4 layers: TPMI=0 | 0 | 4 layers: TPMI=0 |
| … | … | 1-7 | 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 or Second Precoding information, for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission* is either not configured or configured to *fullpowerMode2* or configured to *fullpower*, or if transform precoder is disabled, *maxRank* = 1 or max{*maxRank*, *maxRankSfn*} = 1 or max{*maxRank*, *maxRankSdm*} = 1 or *maxRankSdm*= 1 or *maxRankSfn*= 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 or Second Precoding information, for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission = fullpowerMode1*, or if transform precoder is disabled, *maxRank* = 1 or max{*maxRank*, *maxRankSfn*} = 1 or max{*maxRank*, *maxRankSdm*} = 1 or *maxRankSdm*= 1 or *maxRankSfn*= 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 or Second Precoding information, for 2 antenna ports, if transform precoder is disabled, *maxRank* = 2 or max{*maxRank*, *maxRankSfn*} = 2 or max{*maxRank*, *maxRankSdm*} = 2 or *maxRankSdm*= 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 or Second Precoding information, for 2 antenna ports, if transform precoder is disabled*, maxRank* = 2 or max{*maxRank*, *maxRankSfn*} = 2 or max{*maxRank*, *maxRankSdm*} = 2 or *maxRankSdm*= 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 or *maxRankSfn* = 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 or *maxRankSfn* = 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 or Second Precoding information, 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 or max{*maxRank*, *maxRankSfn*} = 1 or max{*maxRank*, *maxRankSdm*} = 1 or *maxRankSdm*= 1 or *maxRankSfn*= 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 or Second Precoding information, for 2 antenna ports or Second Precoding information, if transform precoder is enabled and *ul-FullPowerTransmission = fullpowerMode1*, or if transform precoder is disabled*, maxRank* = 1 or max{*maxRank*, *maxRankSfn*} = 1 or max{*maxRank*, *maxRankSdm*} = 1 or *maxRankSdm*= 1 or *maxRankSfn*= 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 7.3.1.1.2-5B: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 8, and *CodebookTypeUL*=*Codebook1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *ULcodebookFC-N1N2* = (4, 1) | Bit field mapped to index | *ULcodebookFC-N1N2 = (2, 2)* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layer2: TPMI=0 |
| 17 | 2 layers: TPMI=1 | 17 | 2 layer2: TPMI=1 |
| … | … | … | … |
| 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
| 48 | 3 layers: TPMI=0 | 48 | 3 layers: TPMI=0 |
| 49 | 3 layers: TPMI=1 | 49 | 3 layers: TPMI=1 |
| … | … | … | … |
| 71 | 3 layers: TPMI=23 | 71 | 3 layers: TPMI=23 |
| 72 | 4 layers: TPMI=0 | 72 | 4 layers: TPMI=0 |
| 73 | 4 layers: TPMI=1 | 73 | 4 layers: TPMI=1 |
| … | … | … | … |
| 95 | 4 layers: TPMI=23 | 95 | 4 layers: TPMI=23 |
| 96 | 5 layers: TPMI=0 | 96 | 5 layers: TPMI=0 |
| 97 | 5 layers: TPMI=1 | 97 | 5 layers: TPMI=1 |
| … | … | … | … |
| 103 | 5 layers: TPMI=7 | 103 | 5 layers: TPMI=7 |
| 104 | 6 layers: TPMI=0 | 104 | 6 layers: TPMI=0 |
| 105 | 6 layers: TPMI=1 | 105 | 6 layers: TPMI=1 |
| … | … | … | … |
| 111 | 6 layers: TPMI=7 | 111 | 6 layers: TPMI=7 |
| 112 | 7 layers: TPMI=0 | 112 | 7 layers: TPMI=0 |
| 113 | 7 layers: TPMI=1 | 113 | 7 layers: TPMI=1 |
| … | … | … | … |
| 115 | 7 layers: TPMI=3 | 119 | 7 layers: TPMI=7 |
| 116 | 8 layers: TPMI=0 | 120 | 8 layers: TPMI=0 |
| 117 | 8 layers: TPMI=1 | 121 | 8 layers: TPMI=1 |
| … | … | … | … |
| 119 | 8 layers: TPMI=3 | 127 | 8 layers: TPMI=7 |
| 120-127 | reserved |  |  |

Table 7.3.1.1.2-5C: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 7, and *CodebookTypeUL=Codebook1*

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *ULcodebookFC-N1N2*= (4, 1) | Bit field mapped to index | *ULcodebookFC-N1N2= (2, 2)* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layer2: TPMI=0 |
| 17 | 2 layers: TPMI=1 | 17 | 2 layer2: TPMI=1 |
| … | … | … | … |
| 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
| 48 | 3 layers: TPMI=0 | 48 | 3 layers: TPMI=0 |
| 49 | 3 layers: TPMI=1 | 49 | 3 layers: TPMI=1 |
| … | … | … | … |
| 71 | 3 layers: TPMI=23 | 71 | 3 layers: TPMI=23 |
| 72 | 4 layers: TPMI=0 | 72 | 4 layers: TPMI=0 |
| 73 | 4 layers: TPMI=1 | 73 | 4 layers: TPMI=1 |
| … | … | … | … |
| 95 | 4 layers: TPMI=23 | 95 | 4 layers: TPMI=23 |
| 96 | 5 layers: TPMI=0 | 96 | 5 layers: TPMI=0 |
| 97 | 5 layers: TPMI=1 | 97 | 5 layers: TPMI=1 |
| … | … | … | … |
| 103 | 5 layers: TPMI=7 | 103 | 5 layers: TPMI=7 |
| 104 | 6 layers: TPMI=0 | 104 | 6 layers: TPMI=0 |
| 105 | 6 layers: TPMI=1 | 105 | 6 layers: TPMI=1 |
| … | … | … | … |
| 111 | 6 layers: TPMI=7 | 111 | 6 layers: TPMI=7 |
| 112 | 7 layers: TPMI=0 | 112 | 7 layers: TPMI=0 |
| 113 | 7 layers: TPMI=1 | 113 | 7 layers: TPMI=1 |
| … | … | … | … |
| 115 | 7 layers: TPMI=3 | 119 | 7 layers: TPMI=7 |
| 116-127 | reserved | 120-127 | reserved |

Table 7.3.1.1.2-5D: Precoding information and number of layers, for 8 antenna ports,  
if transform precoder is disabled, *maxRank-n8* = 4, 5 or 6, *CodebookTypeUL=Codebook1,  
ULcodebookFC-N1N2 = (4,1) or (2,2)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *maxRank-n8*=4 | Bit field mapped to index | *maxRank-n8*=5 | Bit field mapped to index | *maxRank-n8=6* |
| 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 |
| … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layer2: TPMI=0 |
| 17 | 2 layers: TPMI=1 | 17 | 2 layers: TPMI=1 | 17 | 2 layer2: TPMI=1 |
| … | … | … | … | … | … |
| 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
| 48 | 3 layers: TPMI=0 | 48 | 3 layers: TPMI=0 | 48 | 3 layers: TPMI=0 |
| 49 | 3 layers: TPMI=1 | 49 | 3 layers: TPMI=1 | 49 | 3 layers: TPMI=1 |
| … | … | … | … | … | … |
| 71 | 3 layers: TPMI=23 | 71 | 3 layers: TPMI=23 | 71 | 3 layers: TPMI=23 |
| 72 | 4 layers: TPMI=0 | 72 | 4 layers: TPMI=0 | 72 | 4 layers: TPMI=0 |
| 73 | 4 layers: TPMI=1 | 73 | 4 layers: TPMI=1 | 73 | 4 layers: TPMI=1 |
| … | … | … | … | … | … |
| 95 | 4 layers: TPMI=23 | 95 | 4 layers: TPMI=23 | 95 | 4 layers: TPMI=23 |
| 96-127 | reserved | 96 | 5 layers: TPMI=0 | 96 | 5 layers: TPMI=0 |
|  |  | 97 | 5 layers: TPMI=1 | 97 | 5 layers: TPMI=1 |
|  |  | … | … | … | … |
|  |  | 103 | 5 layers: TPMI=7 | 103 | 5 layers: TPMI=7 |
|  |  | 104-127 | reserved | 104 | 6 layers: TPMI=0 |
|  |  |  |  | 105 | 6 layers: TPMI=1 |
|  |  |  |  | … | … |
|  |  |  |  | 111 | 6 layers: TPMI=7 |
|  |  |  |  | 112-127 | reserved |

Table 7.3.1.1.2-5E: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or *maxRank*=1 or 2 or 3 if transform precoder is disabled, *CodebookTypeUL=Codebook1, ULcodebookFC-N1N2 = (4,1) or (2,2)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | transform precoder is enabled, or *maxRank*=1 if transform precoder is disabled | Bit field mapped to index | transform precoder is disabled, and *maxRank*=2 | Bit field mapped to index | transform precoder is disabled, and *maxRank=3* |
| 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 |
| … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
|  |  | 16 | 2 layer2: TPMI=0 | 16 | 2 layer2: TPMI=0 |
|  |  | 17 | 2 layer2: TPMI=1 | 17 | 2 layer2: TPMI=1 |
|  |  | … | … | … | … |
|  |  | 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
|  |  | 48-63 | reserved | 48 | 3 layers: TPMI=0 |
|  |  |  |  | 49 | 3 layers: TPMI=1 |
|  |  |  |  | … | … |
|  |  |  |  | 71 | 3 layers: TPMI=23 |
|  |  |  |  | 72-127 | reserved |

Table 7.3.1.1.2-5F: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7 or 8, and *CodebookTypeUL=Codebook4*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *maxRank-n8 = 5* | Bit field mapped to index | *maxRank-n8 = 6* | Bit field mapped to index | *maxRank-n8 = 7* | Bit field mapped to index | *maxRank-n8 = 8* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 |
| 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 |
| … | … | … | … | … | … | … | … |
| 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 |
| 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 |
| … | … | … | … | … | … | … | … |
| 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 |
| 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 |
| … | … | … | … | … | … | … | … |
| 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 |
| 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 |
| … | … | … | … | … | … | … | … |
| 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 |
| 218-255 | reserved | 218 | 6 layers: TPMI=218 | 218 | 6 layers: TPMI=218 | 218 | 6 layers: TPMI=218 |
|  |  | … | … | … | … | … | … |
|  |  | 245 | 6 layers: TPMI=245 | 245 | 6 layers: TPMI=245 | 245 | 6 layers: TPMI=245 |
|  |  | 246-255 | reserved | 246 | 7 layers: TPMI=246 | 246 | 7 layers: TPMI=246 |
|  |  |  |  | … | … | … | … |
|  |  |  |  | 253 | 7 layers: TPMI=253 | 253 | 7 layers: TPMI=253 |
|  |  |  |  | 254-255 | reserved | 254 | 8 layers: TPMI=254 |
|  |  |  |  |  |  | 255 | reserved |

Table 7.3.1.1.2-5G: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank* = 2, 3 or 4, *CodebookTypeUL=Codebook4,* and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *maxRank = 2* | Bit field mapped to index | *maxRank = 3* | Bit field mapped to index | *maxRank = 4* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … |
| 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 |
| 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 |
| … | … | … | … | … | … |
| 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 |
| 36-63 | reserved | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 |
|  |  | … | … | … | … |
|  |  | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 |
|  |  | 92-127 | reserved | 92 | 4 layers: TPMI=92 |
|  |  |  |  | … | … |
|  |  |  |  | 161 | 4 layers: TPMI=161 |
|  |  |  |  | 162-255 | reserved |

Table 7.3.1.1.2-5H: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or *maxRank*=1 if transform is disabled, *CodebookTypeUL=Codebook4,* and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |
| --- | --- |
| Bit field mapped to index | Precoding information and number of layers |
| 0 | 1 layer: TPMI=0 |
| … | … |
| 7 | 1 layer: TPMI=7 |

Table 7.3.1.1.2-5I: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7 or 8, and *CodebookTypeUL=Codebook2*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *maxRank-n8 = 5* | Bit field mapped to index | *maxRank-n8 = 6* | Bit field mapped to index | *maxRank-n8 = 7* | Bit field mapped to index | *maxRank-n8 = 8* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 |
| 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 |
| 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 |
| 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 |
| 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 |
| 698-1023 | reserved | 668 | 6 layers: TPMI=0 | 668 | 6 layers: TPMI=0 | 668 | 6 layers: TPMI=0 |
|  |  | … | … | … | … | … | … |
|  |  | 683 | 6 layers: TPMI=15 | 683 | 6 layers: TPMI=15 | 683 | 6 layers: TPMI=15 |
|  |  | 684-1023 | reserved | 684 | 7 layers: TPMI=0 | 684 | 7 layers: TPMI=0 |
|  |  |  |  | … | … | … | … |
|  |  |  |  | 691 | 7 layers: TPMI=7 | 691 | 7 layers: TPMI=7 |
|  |  |  |  | 692-1023 | reserved | 692 | 8 layers: TPMI=0 |
|  |  |  |  |  |  | … | … |
|  |  |  |  |  |  | 695 | 8 layers: TPMI=3 |
|  |  |  |  |  |  | 696-1023 | reserved |

Table 7.3.1.1.2-5J: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled, or *maxRank* = 1, 2, 3 or 4 if transform precoder is disabled, *CodebookTypeUL=Codebook2,* and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | Transform precoder is enabled, or *maxRank* = 1 if transform precoder is disabled | Bit field mapped to index | transform precoder is disabled *and maxRank = 2* | Bit field mapped to index | transform precoder is disabled *and maxRank = 3* | Bit field mapped to index | transform precoder is disabled *and maxRank = 4* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 |
|  |  | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 |
|  |  | … | … | … | … | … | … |
|  |  | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 |
|  |  | 303-511 | reserved | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 |
|  |  |  |  | … | … | … | … |
|  |  |  |  | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 |
|  |  |  |  | 568-1023 | reserved | 568 | 4 layers: TPMI=0 |
|  |  |  |  |  |  | … | … |
|  |  |  |  |  |  | 635 | 4 layers: TPMI=67 |
|  |  |  |  |  |  | 636-1023 | reserved |

Table 7.3.1.1.2-5K: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7 or 8, and *CodebookTypeUL=Codebook3*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | *maxRank-n8 = 5* | Bit field mapped to index | *maxRank-n8 = 6* | Bit field mapped to index | *maxRank-n8 = 7* | Bit field mapped to index | *maxRank-n8 = 8* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 |
| 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 |
| 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 |
| 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 |
| 864-1023 | reserved | 864 | 6 layers: TPMI=0 | 864 | 6 layers: TPMI=0 | 864 | 6 layers: TPMI=0 |
|  |  | … | … | … | … | … | … |
|  |  | 943 | 6 layers: TPMI=79 | 943 | 6 layers: TPMI=79 | 943 | 6 layers: TPMI=79 |
|  |  | 944-1023 | reserved | 944 | 7 layers: TPMI=0 | 944 | 7 layers: TPMI=0 |
|  |  |  |  | … | … | … | … |
|  |  |  |  | 975 | 7 layers: TPMI=31 | 975 | 7 layers: TPMI=31 |
|  |  |  |  | 976-1023 | reserved | 976 | 8 layers: TPMI=0 |
|  |  |  |  |  |  | … | … |
|  |  |  |  |  |  | 991 | 8 layers: TPMI=15 |
|  |  |  |  |  |  | 992-1023 | reserved |

Table 7.3.1.1.2-5L: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled, or *maxRank* = 1, 2, 3 or 4 if transform precoder is disabled, *CodebookTypeUL=Codebook3,* and *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | Transform precoder is enabled, or *maxRank* = 1 if transform precoder is disabled | Bit field mapped to index | transform precoder is disabled *and maxRank = 2* | Bit field mapped to index | transform precoder is disabled *and maxRank = 3* | Bit field mapped to index | transform precoder is disabled *and maxRank = 4* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
|  |  | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 |
|  |  | … | … | … | … | … | … |
|  |  | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 |
|  |  | 119-127 | reserved | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 |
|  |  |  |  | … | … | … | … |
|  |  |  |  | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 |
|  |  |  |  | 424-511 | reserved | 424 | 4 layers: TPMI=0 |
|  |  |  |  |  |  | … | … |
|  |  |  |  |  |  | 703 | 4 layers: TPMI=279 |
|  |  |  |  |  |  | 704-1024 | reserved |

Table 7.3.1.1.2-5M: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank* = 2, 3 or 4, *CodebookTypeUL=Codebook4,* and *ul-FullPowerTransmission* configured to *fullpowerMode1*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | ***maxRank = 2*** | **Bit field mapped to index** | ***maxRank = 3*** | **Bit field mapped to index** | ***maxRank = 4*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … |
| 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 |
| 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 |
| … | … | … | … | … | … |
| 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 |
| 36 | 1 layer: TPMI=255 | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 |
| 37 | 2 layers: TPMI=256 | … | … | … | … |
| 38-63 | reserved | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 |
|  |  | 92 | 1 layer: TPMI=255 | 92 | 4 layers: TPMI=92 |
|  |  | 93 | 2 layers: TPMI=256 | … | … |
|  |  | 94 | 3 layers: TPMI=257 | 161 | 4 layers: TPMI=161 |
|  |  | 95-127 | reserved | 162 | 1 layer: TPMI=255 |
|  |  |  |  | 163 | 2 layers: TPMI=256 |
|  |  |  |  | 164 | 3 layers: TPMI=257 |
|  |  |  |  | 165 | 4 layers: 258 |
|  |  |  |  | 166-255 | reserved |

Table 7.3.1.1.2-5N: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or *maxRank*=1 if transform is disabled, *CodebookTypeUL=Codebook4,* and *ul-FullPowerTransmission* configured to *fullpowerMode1*

|  |  |
| --- | --- |
| Bit field mapped to index | Precoding information and number of layers |
| 0 | 1 layer: TPMI=0 |
| … | … |
| 7 | 1 layer: TPMI=7 |
| 8 | 1 layer: TPMI=255 |
| 9-15 | reserved |

Table 7.3.1.1.2-5O: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled, or *maxRank* = 1, 2, 3 or 4 if transform precoder is disabled, *CodebookTypeUL=Codebook2,* and *ul-FullPowerTransmission* configured to *fullpowerMode1*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | **Transform precoder is enabled, or maxRank = 1 if transform precoder is disabled** | **Bit field mapped to index** | **Transform precoder is disabled *and maxRank = 2*** | **Bit field mapped to index** | **Transform precoder is disabled *and maxRank = 3*** | **Bit field mapped to index** | **Transform precoder is disabled *and maxRank = 4*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 |
| 32 | 1 layer: TPMI=32 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 |
| 33-63 | reserved | … | … | … | … | … | … |
|  |  | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 |
|  |  | 304 | 1 layer: TPMI=32 | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 |
|  |  | 305-511 | reserved | … | … | … | … |
|  |  |  |  | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 |
|  |  |  |  | 568 | 1 layer: TPMI=32 | 568 | 4 layers: TPMI=0 |
|  |  |  |  | 569-1023 | reserved | … | … |
|  |  |  |  |  |  | 635 | 4 layers: TPMI=67 |
|  |  |  |  |  |  | 636 | 1 layer: TPMI=32 |
|  |  |  |  |  |  | 637-1023 | reserved |

Table 7.3.1.1.2-5P: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled, or *maxRank* = 1, 2, 3 or 4 if transform precoder is disabled, *CodebookTypeUL=Codebook3,* and *ul-FullPowerTransmission* is configured to *fullpowerMode1*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | **Transform precoder is enabled, or *maxRank* = 1 if transform precoder is disabled** | **Bit field mapped to index** | **transform precoder is disabled *and maxRank = 2*** | **Bit field mapped to index** | **transform precoder is disabled *and maxRank = 3*** | **Bit field mapped to index** | **transform precoder is disabled *and maxRank = 4*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 1 layer: TPMI=16 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 |
| 17-31 | reserved | … | … | … | … | … | … |
|  |  | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 |
|  |  | 120 | 1 layer: TPMI=16 | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 |
|  |  | 121 | 2 layers: TPMI=104 | … | … | … | … |
|  |  | 122-127 | reserved | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 |
|  |  |  |  | 424 | 1 layer: TPMI=16 | 424 | 4 layers: TPMI=0 |
|  |  |  |  | 425 | 2 layers: TPMI=104 | … | … |
|  |  |  |  | 426 | 3 layers: 304 | 703 | 4 layers: TPMI=279 |
|  |  |  |  | 427-511 | reserved | 704 | 1 layer: TPMI=16 |
|  |  |  |  |  |  | 705 | 2 layers: TPMI=104 |
|  |  |  |  |  |  | 706 | 3 layers: TPMI=304 |
|  |  |  |  |  |  | 707-1023 | reserved |

**Table 7.3.1.1.2-5Q: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7, 8, *CodebookTypeUL=Codebook4,* and *ul-FullPowerTransmission* is configured to *fullpowerMode1***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | ***maxRank-n8 = 5*** | **Bit field mapped to index** | ***maxRank-n8 = 6*** | **Bit field mapped to index** | ***maxRank-n8 = 7*** | **Bit field mapped to index** | ***maxRank-n8 = 8*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 | 7 | 1 layer: TPMI=7 |
| 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 | 8 | 2 layers: TPMI=8 |
| … | … | … | … | … | … | … | … |
| 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 | 35 | 2 layers: TPMI=35 |
| 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 | 36 | 3 layers: TPMI=36 |
| … | … | … | … | … | … | … | … |
| 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 | 91 | 3 layers: TPMI=91 |
| 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 | 92 | 4 layers: TPMI=92 |
| … | … | … | … | … | … | … | … |
| 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 | 161 | 4 layers: TPMI=161 |
| 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 | 162 | 5 layers: TPMI=162 |
| … | … | … | … | … | … | … | … |
| 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 | 217 | 5 layers: TPMI=217 |
| 218 | 1 layer: TPMI=255 | 218 | 6 layers: TPMI=218 | 218 | 6 layers: TPMI=218 | 218 | 6 layers: TPMI=218 |
| 219 | 2 layers: TPMI=256 | … | … | … | … | … | … |
| 220 | 3 layers: TPMI=257 | 245 | 6 layers: TPMI=245 | 245 | 6 layers: TPMI=245 | 245 | 6 layers: TPMI=245 |
| 221 | 4 layers: TPMI=258 | 246 | 1 layer: TPMI=255 | 246 | 7 layers: TPMI=246 | 246 | 7 layers: TPMI=246 |
| 222-255 | reserved | 247 | 2 layers: TPMI=256 | … | … | … | … |
|  |  | 248 | 3 layers: TPMI=257 | 253 | 7 layers: TPMI=253 | 253 | 7 layers: TPMI=253 |
|  |  | 249 | 4 layers: TPMI=258 | 254 | 1 layer: TPMI=255 | 254 | 8 layers: TPMI=254 |
|  |  | 250-255 | reserved | 255 | 2 layers: TPMI=256 | 255 | 1 layer: TPMI=255 |
|  |  |  |  | 256 | 3 layers: TPMI=257 | 256 | 2 layers: TPMI=256 |
|  |  |  |  | 257 | 4 layers: TPMI=258 | 257 | 3 layers: TPMI=257 |
|  |  |  |  | 258-511 | reserved | 258 | 4 layers: TPMI=258 |
|  |  |  |  |  |  | 259-511 | reserved |

**Table 7.3.1.1.2-5R: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7, 8, *CodebookTypeUL=Codebook2,* and *ul-FullPowerTransmission* is configured to *fullpowerMode1***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | ***maxRank-n8 = 5*** | **Bit field mapped to index** | ***maxRank-n8 = 6*** | **Bit field mapped to index** | ***maxRank-n8 = 7*** | **Bit field mapped to index** | ***maxRank-n8 = 8*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 | 31 | 1 layer: TPMI=31 |
| 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 | 32 | 2 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 | 303 | 2 layers: TPMI=271 |
| 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 | 304 | 3 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 | 567 | 3 layers: TPMI=263 |
| 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 | 568 | 4 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 | 635 | 4 layers: TPMI=67 |
| 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 | 636 | 5 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 | 667 | 5 layers: TPMI=31 |
| 668 | 1 layer: TPMI=32 | 668 | 6 layers: TPMI=0 | 668 | 6 layers: TPMI=0 | 668 | 6 layers: TPMI=0 |
| 669-1023 | reserved | … | … | … | … | … | … |
|  |  | 683 | 6 layers: TPMI=15 | 683 | 6 layers: TPMI=15 | 683 | 6 layers: TPMI=15 |
|  |  | 684 | 1 layer: TPMI=32 | 684 | 7 layers: TPMI=0 | 684 | 7 layers: TPMI=0 |
|  |  | 685-1023 | reserved | … | … | … | … |
|  |  |  |  | 691 | 7 layers: TPMI=7 | 691 | 7 layers: TPMI=7 |
|  |  |  |  | 692 | 1 layer: TPMI=32 | 692 | 8 layers: TPMI=0 |
|  |  |  |  | 693-1023 | reserved | … | … |
|  |  |  |  |  |  | 695 | 8 layers: TPMI=3 |
|  |  |  |  |  |  | 696 | 1 layer: TPMI=32 |
|  |  |  |  |  |  | 697-1023 | reserved |

**Table 7.3.1.1.2-5S: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank-n8* = 5, 6, 7, 8, *CodebookTypeUL=Codebook3,* and *ul-FullPowerTransmission* is configured to *fullpowerMode1***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bit field mapped to index** | ***maxRank-n8 = 5*** | **Bit field mapped to index** | ***maxRank-n8 = 6*** | **Bit field mapped to index** | ***maxRank-n8 = 7*** | **Bit field mapped to index** | ***maxRank-n8 = 8*** |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 | 16 | 2 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 | 119 | 2 layers: TPMI=103 |
| 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 | 120 | 3 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 | 423 | 3 layers: TPMI=303 |
| 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 | 424 | 4 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 | 703 | 4 layers: TPMI=279 |
| 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 | 704 | 5 layers: TPMI=0 |
| … | … | … | … | … | … | … | … |
| 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 | 863 | 5 layers: TPMI=159 |
| 864 | 1 layer: TPMI=16 | 864 | 6 layers: TPMI=0 | 864 | 6 layers: TPMI=0 | 864 | 6 layers: TPMI=0 |
| 865 | 2 layers: TPMI=104 | … | … | … | … | … | … |
| 866 | 3 layers: TPMI=304 | 943 | 6 layers: TPMI=79 | 943 | 6 layers: TPMI=79 | 943 | 6 layers: TPMI=79 |
| 867-1023 | reserved | 944 | 1 layer: TPMI=16 | 944 | 7 layers: TPMI=0 | 944 | 7 layers: TPMI=0 |
|  |  | 945 | 2 layers: TPMI=104 | … | … | … | … |
|  |  | 946 | 3 layers: TPMI=304 | 975 | 7 layers: TPMI=31 | 975 | 7 layers: TPMI=31 |
|  |  | 944-1023 | reserved | 976 | 1 layer: TPMI=16 | 976 | 8 layers: TPMI=0 |
|  |  |  |  | 977 | 2 layers: TPMI=104 | … | … |
|  |  |  |  | 978 | 3 layers: TPMI=304 | 991 | 8 layers: TPMI=15 |
|  |  |  |  | 979-1023 | reserved | 992 | 1 layer: TPMI=16 |
|  |  |  |  |  |  | 993 | 2 layers: TPMI=104 |
|  |  |  |  |  |  | 994 | 3 layers: TPMI=304 |
|  |  |  |  |  |  | 995-1023 | 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,  
*dmrs-TypeEnh* is not configured, *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,  
*dmrs-TypeEnh* is not configured, *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, *multipanelScheme* is not  
configured to *sdmScheme*, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured,  
*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 7.3.1.1.2-10A: Antenna port(s), transform precoder is disabled, *multipanelScheme = sdmScheme*, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, *maxLength*=1, rank = 3

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

Table 7.3.1.1.2-11: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *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,  
*dmrs-TypeEnh* is not configured, *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,  
*dmrs-TypeEnh* is not configured, *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, *multipanelScheme* is not to *sdmScheme*, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, *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 7.3.1.1.2-14A: Antenna port(s), transform precoder is disabled, *multipanelScheme = sdmScheme*, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, *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 | 2 | 0,2,3 | 1 |
| 4-15 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-15: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *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 7.3.1.1.2-15A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 5

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

Table 7.3.1.1.2-15B Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 6

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

Table 7.3.1.1.2-15C: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 7

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

Table 7.3.1.1.2-15D: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 8

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

Table 7.3.1.1.2-16: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *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,  
*dmrs-TypeEnh* is not configured, *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, *multipanelScheme* is not  
configured to *sdmScheme*, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured,  
*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 7.3.1.1.2-18A: Antenna port(s), transform precoder is disabled, *multipanelScheme = sdmScheme*, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, *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 | 2 | 0,2,3 |
| 4 | 3 | 0,2,3 |
| 3-15 | Reserved | Reserved |

Table 7.3.1.1.2-19: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *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 7.3.1.1.2-19A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *maxLength*=1, rank = 5

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

Table 7.3.1.1.2-19B: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*enhanced-dmrs-Typedmrs-TypeEnh* is not configured, *maxLength*=1, rank = 6

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

Table 7.3.1.1.2-20: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *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,  
*dmrs-TypeEnh* is not configured, *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, *multipanelScheme* is not  
configured to *sdmScheme, dmrs-Type*=2, *dmrs-TypeEnh* is not configured,  
*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 7.3.1.1.2-22A: Antenna port(s), transform precoder is disabled, *multipanelScheme = sdmScheme*, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, *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 | 2 | 0,2,3 | 1 |
| 7 | 3 | 0,2,3 | 1 |
| 8-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-23: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *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 7.3.1.1.2-23A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 5

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 3 | 0-4 | 1 |
| 1 | 2 | 0,1,2,3,6 | 2 |
| 12-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-23B Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 6

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

Table 7.3.1.1.2-23C: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 7

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

Table 7.3.1.1.2-23D: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is not configured, *maxLength*=2, rank = 8

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

Table 7.3.1.1.2-24: SRS request

|  |  |  |
| --- | --- | --- |
| Value of SRS request field, or value of ‘SRS request’ index for each cell in the scheduled cell set indicated by SRS request field in DCI 0\_3 or 1\_3 | Triggered aperiodic SRS resource set(s) for DCI format 0\_1, 0\_2, 0\_3, 1\_1, 1\_2, 1\_3, 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, 0\_3, 1\_1, 1\_2 and 1\_3 | 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, 0\_3, 1\_1, 1\_2 and 1\_3 | 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, 0\_3, 1\_1, 1\_2 and 1\_3 | 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 or Second 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 7.3.1.1.2-25A: PTRS-DMRS association for UL PTRS port 0 or for the actual UL PT-RS port if *multipanelScheme* is not configured, or PTRS-DMRS association for UL PTRS port 0 and 1 if multipanelScheme is configured to *sdmScheme* and *maxNrofPortsforSDM* is set to 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Value of MSB** | **DMRS port** |  | **Value of LSB** | **DMRS port** |
| 0 | 1st scheduled DMRS port corresponding to SRS resource indicator field and/or Precoding information and number of layers field |  | 0 | 1st scheduled DMRS port corresponding to Second SRS resource indicator field and/or Second Precoding information field |
| 1 | 2nd scheduled DMRS port corresponding to SRS resource indicator field and/or Precoding information and number of layers field |  | 1 | 2nd scheduled DMRS port corresponding to Second SRS resource indicator field and/or Second Precoding information field |

Table 7.3.1.1.2-25B: PTRS-DMRS association for UL PTRS port 0, *maxRank>4*

|  |  |
| --- | --- |
| **Value** | **DMRS port** |
| 0 | 1st scheduled DMRS port corresponding to the selected Codeword |
| 1 | 2nd scheduled DMRS port corresponding to the selected Codeword |
| 2 | 3rd scheduled DMRS port corresponding to the selected Codeword |
| 3 | 4th scheduled DMRS port corresponding to the selected Codeword |

Table 7.3.1.1.2-26: PTRS-DMRS association or Second 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 7.3.1.1.2-26A: PTRS-DMRS association for UL PTRS ports 0 and 1, *maxRank>4*

|  |  |  |  |
| --- | --- | --- | --- |
| **Value of 2 MSBs** | **DMRS port** | **Value of 2 LSBs** | **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 |
| 2 | 3rd DMRS port which shares PTRS port 0 | 2 | 3rd DMRS port which shares PTRS port 1 |
| 3 | 4th DMRS port which shares PTRS port 0 | 3 | 4th DMRS port which shares PTRS port 1 |

Table 7.3.1.1.2-27: void

Table 7.3.1.1.2-28: SRI indication or 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 |
|  |  | 2 | 2 | 2 | 2 |
|  |  | 3 | reserved | 3 | 3 |

Table 7.3.1.1.2-28A: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5-7 | reserved | 5 | 5 | 5 | 5 | 5 | 5 |
|  |  | 6-7 | reserved | 6 | 6 | 6 | 6 |
|  |  |  |  | 7 | reserved | 7 | 7 |

Table 7.3.1.1.2-29: SRI indication or 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 |
| 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 7.3.1.1.2-29B: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | … | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | … | 7 |  | 7 | 7 |
| 15 | reserved | 20 |  | … | … | 8 |  |
|  |  | 21-31 | reserved | 27 |  | … | … |
|  |  |  |  | 28-31 | reserved | 35 |  |
|  |  |  |  |  |  | 36-63 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1. | | | | | | | |

Table 7.3.1.1.2-29B-1: SRI(s) for 2 layers,

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SRI(s) | SRI(s) for 2 layers, | SRI(s) for 2 layers, | SRI(s) for 2 layers, | SRI(s) for 2 layers, |
|  | 0,1 | 0,1 | 0,1 | 0,1 |
|  | 0,2 | 0,2 | 0,2 | 0,2 |
|  | 0,3 | 0,3 | 0,3 | 0,3 |
|  | 0,4 | 0,4 | 0,4 | 0,4 |
|  | 1,2 | 0,5 | 0,5 | 0,5 |
|  | 1,3 | 1,2 | 0,6 | 0,6 |
|  | 1,4 | 1,3 | 1,2 | 0,7 |
|  | 2,3 | 1,4 | 1,3 | 1,2 |
|  | 2,4 | 1,5 | 1,4 | 1,3 |
|  | 3,4 | 2,3 | 1,5 | 1,4 |
|  |  | 2,4 | 1,6 | 1,5 |
|  |  | 2,5 | 2,3 | 1,6 |
|  |  | 3,4 | 2,4 | 1,7 |
|  |  | 3,5 | 2,5 | 2,3 |
|  |  | 4,5 | 2,6 | 2,4 |
|  |  |  | 3,4 | 2,5 |
|  |  |  | 3,5 | 2,6 |
|  |  |  | 3,6 | 2,7 |
|  |  |  | 4,5 | 3,4 |
|  |  |  | 4,6 | 3,5 |
|  |  |  | 5,6 | 3,6 |
|  |  |  |  | 3,7 |
|  |  |  |  | 4,5 |
|  |  |  |  | 4,6 |
|  |  |  |  | 4,7 |
|  |  |  |  | 5,6 |
|  |  |  |  | 5,7 |
|  |  |  |  | 6,7 |

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, if *multipanelScheme* is not configured,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 7.3.1.1.2-30B: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25-31 | reserved | 40 |  | … | ... | 36 |  |
|  |  | 41-63 | reserved | 62 |  | … | ... |
|  |  |  |  | 63-127 | reserved | 91 |  |
|  |  |  |  |  |  | 92-127 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1 and Table 7.3.1.1.2-30B-1. | | | | | | | |

Table 7.3.1.1.2-30B-1: SRI combinations for 3 layers,

|  | SRI(s) for 3 layers, | SRI(s) for 3 layers, | SRI(s) for 3 layers, | SRI(s) for 3 layers, |
| --- | --- | --- | --- | --- |
|  | 0,1,2 | 0,1,2 | 0,1,2 | 0,1,2 |
|  | 0,1,3 | 0,1,3 | 0,1,3 | 0,1,3 |
|  | 0,1,4 | 0,1,4 | 0,1,4 | 0,1,4 |
|  | 0,2,3 | 0,1,5 | 0,1,5 | 0,1,5 |
|  | 0,2,4 | 0,2,3 | 0,1,6 | 0,1,6 |
|  | 0,3,4 | 0,2,4 | 0,2,3 | 0,1,7 |
|  | 1,2,3 | 0,2,5 | 0,2,4 | 0,2,3 |
|  | 1,2,4 | 0,3,4 | 0,2,5 | 0,2,4 |
|  | 1,3,4 | 0,3,5 | 0,2,6 | 0,2,5 |
|  | 2,3,4 | 0,4,5 | 0,3,4 | 0,2,6 |
|  |  | 1,2,3 | 0,3,5 | 0,2,7 |
|  |  | 1,2,4 | 0,3,6 | 0,3,4 |
|  |  | 1,2,5 | 0,4,5 | 0,3,5 |
|  |  | 1,3,4 | 0,4,6 | 0,3,6 |
|  |  | 1,3,5 | 0,5,6 | 0,3,7 |
|  |  | 1,4,5 | 1,2,3 | 0,4,5 |
|  |  | 2,3,4 | 1,2,4 | 0,4,6 |
|  |  | 2,3,5 | 1,2,5 | 0,4,7 |
|  |  | 2,4,5 | 1,2,6 | 0,5,6 |
|  |  | 3,4,5 | 1,3,4 | 0,5,7 |
|  |  |  | 1,3,5 | 0,6,7 |
|  |  |  | 1,3,6 | 1,2,3 |
|  |  |  | 1,4,5 | 1,2,4 |
|  |  |  | 1,4,6 | 1,2,5 |
|  |  |  | 1,5,6 | 1,2,6 |
|  |  |  | 2,3,4 | 1,2,7 |
|  |  |  | 2,3,5 | 1,3,4 |
|  |  |  | 2,3,6 | 1,3,5 |
|  |  |  | 2,4,5 | 1,3,6 |
|  |  |  | 2,4,6 | 1,3,7 |
|  |  |  | 2,5,6 | 1,4,5 |
|  |  |  | 3,4,5 | 1,4,6 |
|  |  |  | 3,4,6 | 1,4,7 |
|  |  |  | 3,5,6 | 1,5,6 |
|  |  |  | 4,5,6 | 1,5,7 |
|  |  |  |  | 1,6,7 |
|  |  |  |  | 2,3,4 |
|  |  |  |  | 2,3,5 |
|  |  |  |  | 2,3,6 |
|  |  |  |  | 2,3,7 |
|  |  |  |  | 2,4,5 |
|  |  |  |  | 2,4,6 |
|  |  |  |  | 2,4,7 |
|  |  |  |  | 2,5,6 |
|  |  |  |  | 2,5,7 |
|  |  |  |  | 2,6,7 |
|  |  |  |  | 3,4,5 |
|  |  |  |  | 3,4,6 |
|  |  |  |  | 3,4,7 |
|  |  |  |  | 3,5,6 |
|  |  |  |  | 3,5,7 |
|  |  |  |  | 3,6,7 |
|  |  |  |  | 4,5,6 |
|  |  |  |  | 4,5,7 |
|  |  |  |  | 4,6,7 |
|  |  |  |  | 5,6,7 |

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,  
if *multipanelScheme* is not configured,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 7.3.1.1.2-31B: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25 |  | 40 |  | … | ... | 36 |  |
| … | ... | 41 |  | 62 |  | … | ... |
| 29 |  | … | ... | 63 |  | 91 |  |
| 30-31 | reserved | 55 |  | … | ... | 92 |  |
|  |  | 56-63 | reserved | 97 |  | … | ... |
|  |  |  |  | 98-127 | reserved | 161 |  |
|  |  |  |  |  |  | 162-255 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1, Table 7.3.1.1.2-30B-1 and Table 7.3.1.1.2-31B-1. | | | | | | | |

Table 7.3.1.1.2-31B-1: SRI combinations for 4 layers,

|  | SRI(s) for 4 layers, | SRI(s) for 4 layers, | SRI(s) for 4 layers, | SRI(s) for 4 layers, |
| --- | --- | --- | --- | --- |
|  | 0,1,2,3 | 0,1,2,3 | 0,1,2,3 | 0,1,2,3 |
|  | 0,1,2,4 | 0,1,2,4 | 0,1,2,4 | 0,1,2,4 |
|  | 0,1,3,4 | 0,1,2,5 | 0,1,2,5 | 0,1,2,5 |
|  | 0,2,3,4 | 0,1,3,4 | 0,1,2,6 | 0,1,2,6 |
|  | 1,2,3,4 | 0,1,3,5 | 0,1,3,4 | 0,1,2,7 |
|  |  | 0,1,4,5 | 0,1,3,5 | 0,1,3,4 |
|  |  | 0,2,3,4 | 0,1,3,6 | 0,1,3,5 |
|  |  | 0,2,3,5 | 0,1,4,5 | 0,1,3,6 |
|  |  | 0,2,4,5 | 0,1,4,6 | 0,1,3,7 |
|  |  | 0,3,4,5 | 0,1,5,6 | 0,1,4,5 |
|  |  | 1,2,3,4 | 0,2,3,4 | 0,1,4,6 |
|  |  | 1,2,3,5 | 0,2,3,5 | 0,1,4,7 |
|  |  | 1,2,4,5 | 0,2,3,6 | 0,1,5,6 |
|  |  | 1,3,4,5 | 0,2,4,5 | 0,1,5,7 |
|  |  | 2,3,4,5 | 0,2,4,6 | 0,1,6,7 |
|  |  |  | 0,2,5,6 | 0,2,3,4 |
|  |  |  | 0,3,4,5 | 0,2,3,5 |
|  |  |  | 0,3,4,6 | 0,2,3,6 |
|  |  |  | 0,3,5,6 | 0,2,3,7 |
|  |  |  | 0,4,5,6 | 0,2,4,5 |
|  |  |  | 1,2,3,4 | 0,2,4,6 |
|  |  |  | 1,2,3,5 | 0,2,4,7 |
|  |  |  | 1,2,3,6 | 0,2,5,6 |
|  |  |  | 1,2,4,5 | 0,2,5,7 |
|  |  |  | 1,2,4,6 | 0,2,6,7 |
|  |  |  | 1,2,5,6 | 0,3,4,5 |
|  |  |  | 1,3,4,5 | 0,3,4,6 |
|  |  |  | 1,3,4,6 | 0,3,4,7 |
|  |  |  | 1,3,5,6 | 0,3,5,6 |
|  |  |  | 1,4,5,6 | 0,3,5,7 |
|  |  |  | 2,3,4,5 | 0,3,6,7 |
|  |  |  | 2,3,4,6 | 0,4,5,6 |
|  |  |  | 2,3,5,6 | 0,4,5,7 |
|  |  |  | 2,4,5,6 | 0,4,6,7 |
|  |  |  | 3,4,5,6 | 0,5,6,7 |
|  |  |  |  | 1,2,3,4 |
|  |  |  |  | 1,2,3,5 |
|  |  |  |  | 1,2,3,6 |
|  |  |  |  | 1,2,3,7 |
|  |  |  |  | 1,2,4,5 |
|  |  |  |  | 1,2,4,6 |
|  |  |  |  | 1,2,4,7 |
|  |  |  |  | 1,2,5,6 |
|  |  |  |  | 1,2,5,7 |
|  |  |  |  | 1,2,6,7 |
|  |  |  |  | 1,3,4,5 |
|  |  |  |  | 1,3,4,6 |
|  |  |  |  | 1,3,4,7 |
|  |  |  |  | 1,3,5,6 |
|  |  |  |  | 1,3,5,7 |
|  |  |  |  | 1,3,6,7 |
|  |  |  |  | 1,4,5,6 |
|  |  |  |  | 1,4,5,7 |
|  |  |  |  | 1,4,6,7 |
|  |  |  |  | 1,5,6,7 |
|  |  |  |  | 2,3,4,5 |
|  |  |  |  | 2,3,4,6 |
|  |  |  |  | 2,3,4,7 |
|  |  |  |  | 2,3,5,6 |
|  |  |  |  | 2,3,5,7 |
|  |  |  |  | 2,3,6,7 |
|  |  |  |  | 2,4,5,6 |
|  |  |  |  | 2,4,5,7 |
|  |  |  |  | 2,4,6,7 |
|  |  |  |  | 2,5,6,7 |
|  |  |  |  | 3,4,5,6 |
|  |  |  |  | 3,4,5,7 |
|  |  |  |  | 3,4,6,7 |
|  |  |  |  | 3,5,6,7 |
|  |  |  |  | 4,5,6,7 |

Table 7.3.1.1.2-31C: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25 |  | 40 |  | … | ... | 36 |  |
| … | ... | 41 |  | 62 |  | … | ... |
| 29 |  | … | ... | 63 |  | 91 |  |
| 30 | 0,1,2,3,4 | 55 |  | … | ... | 92 |  |
| 31 | reserved | 56 |  | 97 |  | … | ... |
|  |  | … | ... | 98 |  | 161 |  |
|  |  | 61 |  | … | ... | 162 |  |
|  |  | 62-63 | reserved | 118 |  | … | ... |
|  |  |  |  | 119-127 | reserved | 217 |  |
|  |  |  |  |  |  | 218-255 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1, Table 7.3.1.1.2-30B-1, Table 7.3.1.1.2-31B-1 and Table 7.3.1.1.2-31C-1. | | | | | | | |

Table 7.3.1.1.2-31C-1: SRI combinations for 5 layers,

|  | SRI(s) for 5 layers, | SRI(s) for 5 layers, | SRI(s) for 5 layers, |
| --- | --- | --- | --- |
|  | 0,1,2,3,4 | 0,1,2,3,4 | 0,1,2,3,4 |
|  | 0,1,2,3,5 | 0,1,2,3,5 | 0,1,2,3,5 |
|  | 0,1,2,4,5 | 0,1,2,3,6 | 0,1,2,3,6 |
|  | 0,1,3,4,5 | 0,1,2,4,5 | 0,1,2,3,7 |
|  | 0,2,3,4,5 | 0,1,2,4,6 | 0,1,2,4,5 |
|  | 1,2,3,4,5 | 0,1,2,5,6 | 0,1,2,4,6 |
|  |  | 0,1,3,4,5 | 0,1,2,4,7 |
|  |  | 0,1,3,4,6 | 0,1,2,5,6 |
|  |  | 0,1,3,5,6 | 0,1,2,5,7 |
|  |  | 0,1,4,5,6 | 0,1,2,6,7 |
|  |  | 0,2,3,4,5 | 0,1,3,4,5 |
|  |  | 0,2,3,4,6 | 0,1,3,4,6 |
|  |  | 0,2,3,5,6 | 0,1,3,4,7 |
|  |  | 0,2,4,5,6 | 0,1,3,5,6 |
|  |  | 0,3,4,5,6 | 0,1,3,5,7 |
|  |  | 1,2,3,4,5 | 0,1,3,6,7 |
|  |  | 1,2,3,4,6 | 0,1,4,5,6 |
|  |  | 1,2,3,5,6 | 0,1,4,5,7 |
|  |  | 1,2,4,5,6 | 0,1,4,6,7 |
|  |  | 1,3,4,5,6 | 0,1,5,6,7 |
|  |  | 2,3,4,5,6 | 0,2,3,4,5 |
|  |  |  | 0,2,3,4,6 |
|  |  |  | 0,2,3,4,7 |
|  |  |  | 0,2,3,5,6 |
|  |  |  | 0,2,3,5,7 |
|  |  |  | 0,2,3,6,7 |
|  |  |  | 0,2,4,5,6 |
|  |  |  | 0,2,4,5,7 |
|  |  |  | 0,2,4,6,7 |
|  |  |  | 0,2,5,6,7 |
|  |  |  | 0,3,4,5,6 |
|  |  |  | 0,3,4,5,7 |
|  |  |  | 0,3,4,6,7 |
|  |  |  | 0,3,5,6,7 |
|  |  |  | 0,4,5,6,7 |
|  |  |  | 1,2,3,4,5 |
|  |  |  | 1,2,3,4,6 |
|  |  |  | 1,2,3,4,7 |
|  |  |  | 1,2,3,5,6 |
|  |  |  | 1,2,3,5,7 |
|  |  |  | 1,2,3,6,7 |
|  |  |  | 1,2,4,5,6 |
|  |  |  | 1,2,4,5,7 |
|  |  |  | 1,2,4,6,7 |
|  |  |  | 1,2,5,6,7 |
|  |  |  | 1,3,4,5,6 |
|  |  |  | 1,3,4,5,7 |
|  |  |  | 1,3,4,6,7 |
|  |  |  | 1,3,5,6,7 |
|  |  |  | 1,4,5,6,7 |
|  |  |  | 2,3,4,5,6 |
|  |  |  | 2,3,4,5,7 |
|  |  |  | 2,3,4,6,7 |
|  |  |  | 2,3,5,6,7 |
|  |  |  | 2,4,5,6,7 |
|  |  |  | 3,4,5,6,7 |

Table 7.3.1.1.2-31D: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25 |  | 40 |  | … | ... | 36 |  |
| … | ... | 41 |  | 62 |  | … | ... |
| 29 |  | … | ... | 63 |  | 91 |  |
| 30 | 0,1,2,3,4 | 55 |  | … | ... | 92 |  |
| 31 | reserved | 56 |  | 97 |  | … | ... |
|  |  | … | ... | 98 |  | 161 |  |
|  |  | 61 |  | … | ... | 162 |  |
|  |  | 62 | 0,1,2,3,4,5 | 118 |  | … | ... |
|  |  | 63 | reserved | 119 |  | 217 |  |
|  |  |  |  | … | ... | 218 |  |
|  |  |  |  | 125 |  | … | ... |
|  |  |  |  | 126-127 | reserved | 245 |  |
|  |  |  |  |  |  | 246-255 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1, Table 7.3.1.1.2-30B-1, Table 7.3.1.1.2-31B-1, Table 7.3.1.1.2-31C-1 and Table 7.3.1.1.2-31D-1. | | | | | | | |

Table 7.3.1.1.2-31D-1: SRI combinations for 6 layers,

|  | SRI(s) for 6 layers, | SRI(s) for 6 layers, |
| --- | --- | --- |
|  | 0,1,2,3,4,5 | 0,1,2,3,4,5 |
|  | 0,1,2,3,4,6 | 0,1,2,3,4,6 |
|  | 0,1,2,3,5,6 | 0,1,2,3,4,7 |
|  | 0,1,2,4,5,6 | 0,1,2,3,5,6 |
|  | 0,1,3,4,5,6 | 0,1,2,3,5,7 |
|  | 0,2,3,4,5,6 | 0,1,2,3,6,7 |
|  | 1,2,3,4,5,6 | 0,1,2,4,5,6 |
|  |  | 0,1,2,4,5,7 |
|  |  | 0,1,2,4,6,7 |
|  |  | 0,1,2,5,6,7 |
|  |  | 0,1,3,4,5,6 |
|  |  | 0,1,3,4,5,7 |
|  |  | 0,1,3,4,6,7 |
|  |  | 0,1,3,5,6,7 |
|  |  | 0,1,4,5,6,7 |
|  |  | 0,2,3,4,5,6 |
|  |  | 0,2,3,4,5,7 |
|  |  | 0,2,3,4,6,7 |
|  |  | 0,2,3,5,6,7 |
|  |  | 0,2,4,5,6,7 |
|  |  | 0,3,4,5,6,7 |
|  |  | 1,2,3,4,5,6 |
|  |  | 1,2,3,4,5,7 |
|  |  | 1,2,3,4,6,7 |
|  |  | 1,2,3,5,6,7 |
|  |  | 1,2,4,5,6,7 |
|  |  | 1,3,4,5,6,7 |
|  |  | 2,3,4,5,6,7 |

Table 7.3.1.1.2-31E: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25 |  | 40 |  | … | ... | 36 |  |
| … | ... | 41 |  | 62 |  | … | ... |
| 29 |  | … | ... | 63 |  | 91 |  |
| 30 | 0,1,2,3,4 | 55 |  | … | ... | 92 |  |
| 31 | reserved | 56 |  | 97 |  | … | ... |
|  |  | … | ... | 98 |  | 161 |  |
|  |  | 61 |  | … | ... | 162 |  |
|  |  | 62 | 0,1,2,3,4,5 | 118 |  | … | ... |
|  |  | 63 | reserved | 119 |  | 217 |  |
|  |  |  |  | … | ... | 218 |  |
|  |  |  |  | 125 |  | … | ... |
|  |  |  |  | 126 | 0,1,2,3,4,5,6 | 245 |  |
|  |  |  |  | 127 | reserved | 246 | 0,1,2,3,4,5,6 |
|  |  |  |  |  |  | 247 | 0,1,2,3,4,5,7 |
|  |  |  |  |  |  | 248 | 0,1,2,3,4,6,7 |
|  |  |  |  |  |  | 249 | 0,1,2,3,5,6,7 |
|  |  |  |  |  |  | 250 | 0,1,2,4,5,6,7 |
|  |  |  |  |  |  | 251 | 0,1,3,4,5,6,7 |
|  |  |  |  |  |  | 252 | 0,2,3,4,5,6,7 |
|  |  |  |  |  |  | 253 | 1,2,3,4,5,6,7 |
|  |  |  |  |  |  | 254-255 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1, Table 7.3.1.1.2-30B-1, Table 7.3.1.1.2-31B-1, Table 7.3.1.1.2-31C-1 and Table 7.3.1.1.2-31D-1. | | | | | | | |

Table 7.3.1.1.2-31F: 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), | Bit field mapped to index | SRI(s), |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 |  | 5 | 5 | 5 | 5 | 5 | 5 |
| … | ... | 6 |  | 6 | 6 | 6 | 6 |
| 14 |  | … | ... | 7 |  | 7 | 7 |
| 15 |  | 20 |  | … | ... | 8 |  |
| … | ... | 21 |  | 27 |  | … | ... |
| 24 |  | … | ... | 28 |  | 35 |  |
| 25 |  | 40 |  | … | ... | 36 |  |
| … | ... | 41 |  | 62 |  | … | ... |
| 29 |  | … | ... | 63 |  | 91 |  |
| 30 | 0,1,2,3,4 | 55 |  | … | ... | 92 |  |
| 31 | reserved | 56 |  | 97 |  | … | ... |
|  |  | … | ... | 98 |  | 161 |  |
|  |  | 61 |  | … | ... | 162 |  |
|  |  | 62 | 0,1,2,3,4,5 | 118 |  | … | ... |
|  |  | 63 | reserved | 119 |  | 217 |  |
|  |  |  |  | … | ... | 218 |  |
|  |  |  |  | 125 |  | … | ... |
|  |  |  |  | 126 | 0,1,2,3,4,5,6 | 245 |  |
|  |  |  |  | 127 | reserved | 246 | 0,1,2,3,4,5,6 |
|  |  |  |  |  |  | 247 | 0,1,2,3,4,5,7 |
|  |  |  |  |  |  | 248 | 0,1,2,3,4,6,7 |
|  |  |  |  |  |  | 249 | 0,1,2,3,5,6,7 |
|  |  |  |  |  |  | 250 | 0,1,2,4,5,6,7 |
|  |  |  |  |  |  | 251 | 0,1,3,4,5,6,7 |
|  |  |  |  |  |  | 252 | 0,2,3,4,5,6,7 |
|  |  |  |  |  |  | 253 | 1,2,3,4,5,6,7 |
|  |  |  |  |  |  | 254 | 0,1,2,3,4,5,6,7 |
|  |  |  |  |  |  | 255 | reserved |
| where SRIs are as given in Table 7.3.1.1.2-29B-1, Table 7.3.1.1.2-30B-1, Table 7.3.1.1.2-31B-1, Table 7.3.1.1.2-31C-1 and Table 7.3.1.1.2-31D-1. | | | | | | | |

Table 7.3.1.1.2-32: SRI indication or Second 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 or Second 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 or Second 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 and DCI format 0\_2, configured by  
higher layer parameter *ul-AccessConfigListDCI-0-1* and *ul-AccessConfigListDCI-0-2*, respectively,  
in frequency range 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 TS 37.213 [14] | 0 | 1 |
| 1 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 2 |
| 2 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 3 |
| 3 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 4 |
| 4 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 1 |
| 5 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 2 |
| 6 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 3 |
| 7 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 4 |
| 8 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 1 |
| 9 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 2 |
| 10 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 3 |
| 11 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 4 |
| 12 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 1 |
| 13 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 2 |
| 14 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 3 |
| 15 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 4 |
| 16 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 1 |
| 17 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 2 |
| 18 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 3 |
| 19 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 4 |
| 20 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 1 |
| 21 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 2 |
| 22 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 3 |
| 23 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 4 |
| 24 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 1 |
| 25 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 2 |
| 26 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 3 |
| 27 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 4 |
| 28 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 1 |
| 29 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 2 |
| 30 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 3 |
| 31 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 4 |
| 32 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 1 |
| 33 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 2 |
| 34 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 3 |
| 35 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 4 |
| 36 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 1 |
| 37 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 2 |
| 38 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 3 |
| 39 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 4 |
| 40 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 1 |
| 41 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 2 |
| 42 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 3 |
| 43 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 4 |

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

|  |  |
| --- | --- |
| Entry index | Channel Access Type |
| 0 | Type 1 channel access defined in clause 4.4.1 of TS 37.213 [14] |
| 1 | Type 2 channel access defined in clause 4.4.2 of TS 37.213 [14] |
| 2 | Type 3 channel access defined in clause 4.4.3 of TS 37.213 [14] |

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;  If there are two indicated joint/UL TCI states, the first indicated joint/UL TCI state is applied to the corresponding PUSCH transmission occasions. |
| 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;  If there are two indicated joint/UL TCI states, the second indicated joint/UL TCI state is applied to the corresponding PUSCH transmission occasions. |
| 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;  If there are two indicated joint/UL TCI states, the first indicated joint/UL TCI state is applied to the PUSCH transmission occasions/antenna ports associated with the first SRS resource set, and the second indicated joint/UL TCI state is applied to the PUSCH transmission occasions/antenna ports 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;  If there are two indicated joint/UL TCI states, the first indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the first SRS resource set, and the second indicated 3UL TCI state is applied to the PUSCH transmission occasions associated with the second SRS resource set.  If *multipanelScheme* is configured, this row is reserved. |
| 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*. When only one SRS resource set is configured by higher layer parameter *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, and associated with the higher layer parameter usage of value '*codebook*' or '*nonCodeBook*' respectively, the first SRS resource set is the SRS resource set. The association of the first and second SRS resource sets to PUSCH repetitions for each bit field index value is as defined in Clause 6.1.2.1 of TS 38.214 [6].  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'.* | |

Table 7.3.1.1.2-37: SRS offset indicator

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | Available slot offset, K=2 | Bit field mapped to index | Available slot offset, K=3 | Bit field mapped to index | Available slot offset, K=4 |
| 0 | The 1st entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise | 0 | The 1st entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise | 0 | The 1st entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise |
| 1 | The 2nd entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise | 1 | The 2nd entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise | 1 | The 2nd entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise |
|  |  | 2 | The 3rd entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise | 2 | The 3rd entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise |
|  |  | 3 | Reserved | 3 | The 4th entry in *availableSlotOffsetList*, if configured for the aperiodic SRS resource set;  0, otherwise |

Table 7.3.1.1.2-38: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *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 | 1 | 8 |
| 7 | 1 | 9 |
| 8 | 2 | 8 |
| 9 | 2 | 9 |
| 10 | 2 | 10 |
| 11 | 2 | 11 |
| 12-15 | Reserved | Reserved |

Table 7.3.1.1.2-39: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *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 | 1 | 8,9 |
| 5 | 2 | 8,9 |
| 6 | 2 | 10,11 |
| 7 | 2 | 9,11 |
| 8-15 | Reserved | Reserved |

Table 7.3.1.1.2-40: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *multipanelScheme* is not configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *maxLength*=1, rank = 3

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

Table 7.3.1.1.2-40A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *multipanelScheme* is configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *maxLength*=1, rank = 3

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

Table 7.3.1.1.2-41: Antenna port(s), transform precoder is disabled, dmrs-Type=1,  
*dmrs-TypeEnh* is configured, maxLength=1, rank = 4

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

Table 7.3.1.1.2-42: Antenna port(s), transform precoder is disabled, dmrs-Type=1,  
*dmrs-TypeEnh* is configured, maxLength=1, rank = 5

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0,1,2,3,8 |
| 1-15 | Reserved | Reserved |

Table 7.3.1.1.2-43: Antenna port(s), transform precoder is disabled, dmrs-Type=1,  
*dmrs-TypeEnh* is configured, maxLength=1, rank = 6

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0,1,2,3,8,10 |
| 1-15 | Reserved | Reserved |

Table 7.3.1.1.2-44: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 7

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0,1,2,3,8,9,10 |
| 1-15 | Reserved | Reserved |

Table 7.3.1.1.2-45: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 8

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

Table 7.3.1.1.2-46: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *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 | 1 | 8 | 1 |
| 15 | 1 | 9 | 1 |
| 16 | 2 | 8 | 1 |
| 17 | 2 | 9 | 1 |
| 18 | 2 | 10 | 1 |
| 19 | 2 | 11 | 1 |
| 20 | 2 | 8 | 2 |
| 21 | 2 | 9 | 2 |
| 22 | 2 | 10 | 2 |
| 23 | 2 | 11 | 2 |
| 24 | 2 | 12 | 2 |
| 25 | 2 | 13 | 2 |
| 26 | 2 | 14 | 2 |
| 27 | 2 | 15 | 2 |
| 28 | 1 | 0 | 2 |
| 29 | 1 | 1 | 2 |
| 30 | 1 | 8 | 2 |
| 31 | 1 | 9 | 2 |

Table 7.3.1.1.2-47: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *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 | 1 | 8,9 | 1 |
| 11 | 2 | 8,9 | 1 |
| 12 | 2 | 10,11 | 1 |
| 13 | 2 | 8,9 | 2 |
| 14 | 2 | 10,11 | 2 |
| 15 | 2 | 12,13 | 2 |
| 16 | 2 | 14,15 | 2 |
| 17 | 2 | 9,11 | 1 |
| 18 | 2 | 1,3 | 1 |
| 19 | 2 | 0,2 | 2 |
| 20 | 2 | 1,3 | 2 |
| 21 | 2 | 4,6 | 2 |
| 22 | 2 | 5,7 | 2 |
| 23 | 2 | 8,10 | 2 |
| 24 | 2 | 9,11 | 2 |
| 25 | 2 | 12,14 | 2 |
| 26 | 2 | 13,15 | 2 |
| 27 | 1 | 0,1 | 2 |
| 28 | 1 | 8,9 | 2 |
| 29 | 1 | 4,5 | 2 |
| 30 | 1 | 12,13 | 2 |
| 31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-48: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *multipanelScheme* is not configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 2 | 9-11 | 1 |
| 4 | 2 | 8,9,12 | 2 |
| 5 | 2 | 10,11,14 | 2 |
| 6 | 1 | 0,1,8 | 1 |
| 7 | 2 | 0,1,8 | 1 |
| 8 | 2 | 2,3,10 | 1 |
| 9 | 2 | 0,1,8 | 2 |
| 10 | 2 | 4,5,12 | 2 |
| 11 | 2 | 2,3,10 | 2 |
| 12 | 2 | 6,7,14 | 2 |
| 13 | 2 | 5,8,9 | 2 |
| 14 | 2 | 7,10,11 | 2 |
| 15 | 2 | 7,12,13 | 2 |
| 16-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-48A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1, *multipanelScheme* is configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 2 | 9-11 | 1 |
| 4 | 2 | 8,9,12 | 2 |
| 5 | 2 | 10,11,14 | 2 |
| 6 | 1 | 0,1,8 | 1 |
| 7 | 2 | 0,1,8 | 1 |
| 8 | 2 | 2,3,10 | 1 |
| 9 | 2 | 0,1,8 | 2 |
| 10 | 2 | 4,5,12 | 2 |
| 11 | 2 | 2,3,10 | 2 |
| 12 | 2 | 6,7,14 | 2 |
| 13 | 2 | 5,8,9 | 2 |
| 14 | 2 | 7,10,11 | 2 |
| 15 | 2 | 7,12,13 | 2 |
| 16 | 2 | 0,2,3 | 1 |
| 17-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-49: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *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 | 2 | 8-11 | 1 |
| 5 | 2 | 8,9,12,13 | 2 |
| 6 | 2 | 10,11,14,15 | 2 |
| 7 | 2 | 1,3,5,7 | 2 |
| 8 | 1 | 0,1,8,9 | 1 |
| 9 | 2 | 0,1,8,9 | 1 |
| 10 | 2 | 2,3,10,11 | 1 |
| 11 | 1 | 0,1,8,9 | 2 |
| 12 | 1 | 4,5,12,13 | 2 |
| 13 | 2 | 0,1,8,9 | 2 |
| 14 | 2 | 4,5,12,13 | 2 |
| 15 | 2 | 2,3,10,11 | 2 |
| 16 | 2 | 6,7,14,15 | 2 |
| 17-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-50: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 5

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

Table 7.3.1.1.2-51: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 6

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0,1,2,3,4,6 | 2 |
| 1 | 2 | 0,1,2,3,8,10 | 1 |
| 2 | 1 | 0,1,4,5,8,12 | 2 |
| 3 | 2 | 0,1,4,5,8,12 | 2 |
| 4-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-52: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 7

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0,1,2,3,4,5,6 | 2 |
| 1 | 2 | 0,1,2,3,8,9,10 | 1 |
| 2 | 1 | 0,1,4,5,8,9,12 | 2 |
| 3 | 2 | 0,1,4,5,8,9,12 | 2 |
| 4-31 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-53: Antenna port(s), transform precoder is disabled, *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 8

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

Table 7.3.1.1.2-54: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 1 | 12 |
| 13 | 1 | 13 |
| 14 | 2 | 12 |
| 15 | 2 | 13 |
| 16 | 2 | 14 |
| 17 | 2 | 15 |
| 18 | 3 | 12 |
| 19 | 3 | 13 |
| 20 | 3 | 14 |
| 21 | 3 | 15 |
| 22 | 3 | 16 |
| 23 | 3 | 17 |
| 24-31 | Reserved | Reserved |

Table 7.3.1.1.2-55: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 1 | 12,13 |
| 8 | 2 | 12,13 |
| 9 | 2 | 14,15 |
| 10 | 3 | 12,13 |
| 11 | 3 | 14,15 |
| 12 | 3 | 16,17 |
| 13 | 3 | 13,15 |
| 14 | 2 | 13,15 |
| 15-31 | Reserved | Reserved |

Table 7.3.1.1.2-56: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *multipanelScheme* is not configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 1 | 0,1,12 |
| 4 | 2 | 0,1,12 |
| 5 | 2 | 2,3,14 |
| 6 | 3 | 0,1,12 |
| 7 | 3 | 2,3,14 |
| 8 | 3 | 4,5,16 |
| 9 | 3 | 13,15,17 |
| 10-31 | Reserved | Reserved |

Table 7.3.1.1.2-56A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *multipanelScheme* is configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 1 | 0,1,12 |
| 4 | 2 | 0,1,12 |
| 5 | 2 | 2,3,14 |
| 6 | 3 | 0,1,12 |
| 7 | 3 | 2,3,14 |
| 8 | 3 | 4,5,16 |
| 9 | 3 | 13,15,17 |
| 10 | 2 | 0,2,3 |
| 11-31 | Reserved | Reserved |

Table 7.3.1.1.2-57: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 1 | 0,1,12,13 |
| 3 | 2 | 0,1,12,13 |
| 4 | 2 | 2,3,14,15 |
| 5 | 3 | 0,1,12,13 |
| 6 | 3 | 2,3,14,15 |
| 7 | 3 | 4,5,16,17 |
| 8-31 | Reserved | Reserved |

Table 7.3.1.1.2-58: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 5

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 3 | 0-4 |
| 1 | 2 | 0,1,2,3,12 |
| 2 | 3 | 0,1,2,3,12 |
| 3-31 | Reserved | Reserved |

Table 7.3.1.1.2-59: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 6

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 3 | 0-5 |
| 1 | 2 | 0,1,2,3,12,14 |
| 2 | 3 | 0,1,2,3,12,14 |
| 3-31 | Reserved | Reserved |

Table 7.3.1.1.2-60: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 7

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-3,12-14 |
| 1 | 3 | 0-3,12-14 |
| 2-31 | Reserved | Reserved |

Table 7.3.1.1.2-61: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1, rank = 8

|  |  |  |
| --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 2 | 0-3,12-15 |
| 1 | 3 | 0-3,12-15 |
| 2-31 | Reserved | Reserved |

Table 7.3.1.1.2-62: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 1 | 12 | 1 |
| 29 | 1 | 13 | 1 |
| 30 | 2 | 12 | 1 |
| 31 | 2 | 13 | 1 |
| 32 | 2 | 14 | 1 |
| 33 | 2 | 15 | 1 |
| 34 | 3 | 12 | 1 |
| 35 | 3 | 13 | 1 |
| 36 | 3 | 14 | 1 |
| 37 | 3 | 15 | 1 |
| 38 | 3 | 16 | 1 |
| 39 | 3 | 17 | 1 |
| 40 | 3 | 12 | 2 |
| 41 | 3 | 13 | 2 |
| 42 | 3 | 14 | 2 |
| 43 | 3 | 15 | 2 |
| 44 | 3 | 16 | 2 |
| 45 | 3 | 17 | 2 |
| 46 | 3 | 18 | 2 |
| 47 | 3 | 19 | 2 |
| 48 | 3 | 20 | 2 |
| 49 | 3 | 21 | 2 |
| 50 | 3 | 22 | 2 |
| 51 | 3 | 23 | 2 |
| 52 | 1 | 12 | 2 |
| 53 | 1 | 13 | 2 |
| 54 | 1 | 18 | 2 |
| 55 | 1 | 19 | 2 |
| 56-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-63: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 1 | 12,13 | 1 |
| 20 | 2 | 12,13 | 1 |
| 21 | 2 | 14,15 | 1 |
| 22 | 3 | 12,13 | 1 |
| 23 | 3 | 14,15 | 1 |
| 24 | 3 | 16,17 | 1 |
| 25 | 3 | 12,13 | 2 |
| 26 | 3 | 14,15 | 2 |
| 27 | 3 | 16,17 | 2 |
| 28 | 3 | 18,19 | 2 |
| 29 | 3 | 20,21 | 2 |
| 30 | 3 | 22,23 | 2 |
| 31 | 1 | 12,13 | 2 |
| 32 | 1 | 18,19 | 2 |
| 33 | 2 | 12,13 | 2 |
| 34 | 2 | 14,15 | 2 |
| 35 | 2 | 18,19 | 2 |
| 36 | 2 | 20,21 | 2 |
| 37 | 3 | 13,15 | 1 |
| 38 | 2 | 13,15 | 1 |
| 39-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-64: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *multipanelScheme* is not configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 1 | 0,1,12 | 1 |
| 7 | 2 | 0,1,12 | 1 |
| 8 | 2 | 2,3,14 | 1 |
| 9 | 3 | 0,1,12 | 1 |
| 10 | 3 | 2,3,14 | 1 |
| 11 | 3 | 4,5,16 | 1 |
| 12 | 3 | 7,12,13 | 2 |
| 13 | 3 | 9,14,15 | 2 |
| 14 | 3 | 11,16,17 | 2 |
| 15 | 3 | 9,18,19 | 2 |
| 16 | 3 | 18,19,20 | 2 |
| 17 | 3 | 21,22,23 | 2 |
| 18 | 3 | 13,15,17 | 1 |
| 19-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-64A: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2, *multipanelScheme* is configured to *sdmScheme*, *dmrs-TypeEnh* is configured, *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 | 1 | 0,1,12 | 1 |
| 7 | 2 | 0,1,12 | 1 |
| 8 | 2 | 2,3,14 | 1 |
| 9 | 3 | 0,1,12 | 1 |
| 10 | 3 | 2,3,14 | 1 |
| 11 | 3 | 4,5,16 | 1 |
| 12 | 3 | 7,12,13 | 2 |
| 13 | 3 | 9,14,15 | 2 |
| 14 | 3 | 11,16,17 | 2 |
| 15 | 3 | 9,18,19 | 2 |
| 16 | 3 | 18,19,20 | 2 |
| 17 | 3 | 21,22,23 | 2 |
| 18 | 3 | 13,15,17 | 1 |
| 19 | 2 | 0,2,3 | 1 |
| 20-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-65: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *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 | 3 | 12,13,18,19 | 2 |
| 6 | 3 | 14,15,20,21 | 2 |
| 7 | 3 | 16,17,22,23 | 2 |
| 8 | 1 | 0,1,12,13 | 1 |
| 9 | 2 | 0,1,12,13 | 1 |
| 10 | 2 | 2,3,14,15 | 1 |
| 11 | 3 | 0,1,12,13 | 1 |
| 12 | 3 | 2,3,14,15 | 1 |
| 13 | 3 | 4,5,16,17 | 1 |
| 14-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-66: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 5

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 3 | 0-4 | 1 |
| 1 | 2 | 0,1,2,3,6 | 2 |
| 2 | 2 | 0,1,2,3,12 | 1 |
| 3 | 3 | 0,1,2,3,12 | 1 |
| 4 | 1 | 0,1,6,7,12 | 2 |
| 5 | 2 | 0,1,6,7,12 | 2 |
| 6 | 3 | 0,1,6,7,12 | 2 |
| 7-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-67: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 6

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 3 | 0-5 | 1 |
| 1 | 2 | 0,1,2,3,6,8 | 2 |
| 2 | 2 | 0-3,12,14 | 1 |
| 3 | 3 | 0-3,12,14 | 1 |
| 4 | 1 | 0,1,6,7,12,18 | 2 |
| 5 | 2 | 0,1,6,7,12,18 | 2 |
| 6 | 3 | 0,1,6,7,12,18 | 2 |
| 7-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-68: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 7

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0,1,2,3,6,7,8 | 2 |
| 1 | 2 | 0-3,12-14 | 1 |
| 2 | 3 | 0-3,12-14 | 1 |
| 3 | 1 | 0,1,6,7,12,13,18 | 2 |
| 4 | 2 | 0,1,6,7,12,13,18 | 2 |
| 5 | 3 | 0,1,6,7,12,13,18 | 2 |
| 6-63 | Reserved | Reserved | Reserved |

Table 7.3.1.1.2-69: Antenna port(s), transform precoder is disabled, *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2, rank = 8

|  |  |  |  |
| --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 2 | 0,1,2,3,6,7,8,9 | 2 |
| 1 | 2 | 0-3,12-15 | 1 |
| 2 | 3 | 0-3,12-15 | 1 |
| 3 | 1 | 0,1,6,7,12,13,18,19 | 2 |
| 4 | 2 | 0,1,6,7,12,13,18,19 | 2 |
| 5 | 3 | 0,1,6,7,12,13,18,19 | 2 |
| 6-63 | Reserved | Reserved | Reserved |

##### 7.3.1.1.3 Format 0\_2

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

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

- Identifier for DCI formats - 1 bit

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

- Carrier indicator - 0, 1, 2 or 3 bits determined by higher layer parameter *carrierIndicatorSizeDCI-0-2*, as defined in Clause 10.1 of [5, TS38.213]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

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

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

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

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

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

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

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

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

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

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

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

- For PUSCH hopping with resource allocation type 1:

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

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

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

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

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

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

- Frequency hopping flag - 0 or 1 bit:

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

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

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

- New data indicator - 1 bit

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

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

- 1 bit according to Table 7.3.1.2.3-1;

- 2 bits according to Table 7.3.1.1.1-2.

- Transform precoder indicator - 0 or 1 bit

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

- 0 bit otherwise.

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

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

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

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

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

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

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

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

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

- 2nd downlink assignment index - 0 or 2 bits

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

- 0 bit otherwise.

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

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

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

- 0 bit otherwise.

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

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

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

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

- SRS resource set indicator - 0 or 2 bits

- 2 bits according to Table 7.3.1.1.2-36 if

- *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with the *usage* of value '*nonCodeBook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided, or

- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided;

- 0 bit otherwise.

- SRS resource indicator - number of bits determined by the following:*'*

- bits according to Tables 7.3.1.1.2-28/28A/29/29B/30/30B/31/31B 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,

- is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_2, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*,

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

and

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

- Lmax is given by max{*maxMIMO-LayersDCI-0-2*, *maxMIMO-LayersforSdmDCI-0-2*} if *maxMIMO-LayersforSdmDCI-0-2* is configured

- Lmax is given by max{*maxMIMO-LayersDCI-0-2*, *maxMIMO-LayersforSfnDCI-0-2*} if *maxMIMO-LayersforSfnDCI-0-2* is configured

- Lmax is given by *maxMIMO-LayersDCI-0-2* otherwise

- 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 7.3.1.1.2-32/32A/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,

- is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_2, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmD*CI,

- 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'*.

When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the first SRS resource set is associated with *coresetPoolIndex* value 0 and the second SRS resource set is associated with *coresetPoolIndex* value 1, where the first and the second SRS resource sets are respectively the ones with lower and higher *srs-ResourceSetId* of the two SRS resources sets, and the first and second SRS resource sets 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'.*

- Second SRS resource indicator - number of bits determined by the following:

- 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*, the higher layer parameter *maxMIMO-LayersforSdmDCI-0-2* is not configured, and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set*,* and

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

- Lmax is given by *maxMIMO-LayersforSfnDCI-0-2* if *maxMIMO-LayersforSfnDCI-0-2* is configured

- Lmax is given by *maxMIMO-LayersDCI-0-2* otherwise

- 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 7.3.1.1.2-28/29 if the higher layer parameter *txConfig = nonCodebook*, the higher layer parameter *maxMIMO-LayersforSdmDCI-0-2* is configured and SRS resource set indicator field is present, where is the number of configured SRS resources in the second SRS resource set, where the second SRS resource set is composed of the first SRS resources together with other configurations in the SRS resource set, or in the SRS resource set with higher srs-ResourceSetId of two SRS resources sets, configured by higher layer parameter *srs-ResourceSetToAddModList*, if any, and associated with the higher layer parameter *usage* of value '*nonCodeBook*', except for the higher layer parameters *'srs-ResourceSetId' and 'srs-ResourceIdList',* and *Lmax* is given by *maxMIMO-LayersforSdmDCI-0-2.*

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

- 0 bit otherwise.

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

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

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

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRankDCI-0-2* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} = 2 if *multipanelScheme =* *sfnScheme* or max{*maxRanDCI-0-2k*, *maxRankSdmDCI-0-2*} = 2 if *multipanelScheme =* *sdmScheme,* 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 *maxRankDCI-0-2=1* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} = 1 if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} = 1 if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} = 1 if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} = 1 if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} = 2 if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} = 2 if *multipanelScheme =* *sdmScheme*, 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 *maxRankDCI-0-2=1* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*}*=1* if *multipanelScheme =* *sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*}*=1* if *multipanelScheme =* *sdmScheme*, 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* if *multipanelScheme* is not configured or max{*maxRankDCI-0-2*, *maxRankSfnDCI-0-2*} = 1 if *multipanelScheme = sfnScheme* or max{*maxRankDCI-0-2*, *maxRankSdmDCI-0-2*} = 1 if *multipanelScheme = sdmScheme*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*.

- 7 bits according to Table 7.3.1.1.2-5D for 8 antenna ports by replacing *maxRank-n8* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook1*, transform precoder is disabled, *maxRankDCI-0-2* =4, and according to *maxRankDCI-0-2*;

- 4, 6 or 7 bits according to Table 7.3.1.1.2-5E for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook1*, transform precoder is enabled or *maxRankDCI-0-2* =1, 2 or 3 if transform precoder is disabled, and according to transform precoder and *maxRankDCI-0-2*;

- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5G for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook4*, transform precoder is disabled, *maxRankDCI-0-2*=2, 3 or 4, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to *maxRankDCI-0-2*;

- 3 bits according to Table 7.3.1.1.2-5H for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook4*, transform precoder is enabled or *maxRankDCI-0-2*=1 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*.

- 5, 9 or 10 bits according to Table 7.3.1.1.2-5J for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook2*, transform precoder is enabled or *maxRankDCI-0-2* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to transform precoder and *maxRankDCI-0-2*;

- 4, 7, 9 or 10 bits according to Table 7.3.1.1.2-5L for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook3*, transform precoder is enabled or *maxRankDCI-0-2* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, and according to transform precoder and *maxRankDCI-0-2*;

- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5M for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook4*, transform precoder is disabled, *maxRankDCI-0-2*=2, 3 or 4, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to *maxRankDCI-0-2*;

- 4 bits according to Table 7.3.1.1.2-5N for 8 antenna ports, if *CodebookTypeUL=Codebook4*, transform precoder is enabled or *maxRankDCI-0-2*=1 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*.

- 6, 9 or 10 bits according to Table 7.3.1.1.2-5O for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook2*, transform precoder is enabled or *maxRankDCI-0-2* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to transform precoder and *maxRankDCI-0-2*;

- 5, 7, 9 or 10 bits according to Table 7.3.1.1.2-5P for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookTypeUL=Codebook3*, transform precoder is enabled or *maxRankDCI-0-2* =1, 2, 3 or 4 if transform precoder is disabled, *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and according to transform precoder and *maxRankDCI-0-2*;

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

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

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

When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and is provided *enableSTx2PofmDCI*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the Precoding information and number of layers field is associated with the SRS resource set that is associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_2.

- 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2* if *multipanelScheme =* *sfnScheme*, and *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-2D with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1,* the values of higher layer parameters *maxRankDCI-0-2=2* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2=2* if *multipanelScheme =* *sfnScheme,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetDCI-0-2*;

- 3 or 4 bits according to Table 7.3.1.1.2-2E with the same number of layers indicated by Precoding information and number of layers field for 4 antenna ports, if SRS resource set indicator field is present, *txConfig = codebook, ul-FullPowerTransmission =fullpowerMode1,* *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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2* if *multipanelScheme =* *sfnScheme* 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2=1* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2=2* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2* if *multipanelScheme =* *sfnScheme*, 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* if *multipanelScheme* is not configured or *maxRankSfnDCI-0-2=1* if *multipanelScheme =* *sfnScheme*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetDCI-0-2*.

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

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

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

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

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

- 2, 3, 4, 5 or 6 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 7.3.1.1.2-8/9/10/10A/11 according to the value of rank, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, and *maxLength*=1;

- 4 bits as defined by Tables 7.3.1.1.2-12/13/14/14A/15 according to the value of rank, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is not configured, and *maxLength*=2;

- 4 bits as defined by Tables 7.3.1.1.2-16/17/18/18A/19 according to the value of rank, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, and *maxLength*=1;

- 5 bits as defined by Tables 7.3.1.1.2-20/21/22/22A/23 according to the value of rank, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is not configured, and *maxLength*=2.

- 4 bits as defined by Tables 7.3.1.1.2-38/39/40/40A/41, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is configured, and *maxLength*=1;

- 5 bits as defined by Tables 7.3.1.1.2-46/47/48/48A/49, if transform precoder is disabled, *dmrs-Type*=1, *dmrs-TypeEnh* is configured, and *maxLength*=2;

- 5 bits as defined by Tables 7.3.1.1.2-54/55/56/56A/57, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is configured, and *maxLength*=1;

- 6 bits as defined by Tables 7.3.1.1.2-62/63/64/64A/65, if transform precoder is disabled, *dmrs-Type*=2, *dmrs-TypeEnh* is configured, and *maxLength*=2.

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, and the value of rank is

- the sum of the value determined according to the SRS resource indicator field and the value determined according to the second SRS resource indicator field, if *txConfig = nonCodebook* and *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "10"

- the sum of the value determined according to the Precoding information and number of layers field and the value determined according to the Second Precoding information, if *txConfig = codebook* and *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "10"

- determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and *multipanelScheme =* *sdmScheme* is not configured, , or if the higher layer parameter *txConfig = nonCodebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "00" or “01”

- determined according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook* and *multipanelScheme =* *sdmScheme* is not configured, or if the higher layer parameter *txConfig = codebook*, *multipanelScheme =* *sdmScheme* and SRS resource set indicator field equals "00" or "01".

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

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

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

- SRS request - 0, 1, 2 or 3 bits

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

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

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

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

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

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

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

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

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

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

- 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1* and *multipanelScheme* is not configured, or if *maxRankDCI-0-2=1* and *maxRankSfnDCI-0-2=1*, or if *maxRankDCI-0-2=1* and *maxRankSdmDCI-0-2=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;

- 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.

- When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and maxRank*DCI-0-2*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.

- When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRankDCI-0-2=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.

- When one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and "11" and *maxRankDCI-0-2=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

- When two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and *multipanelScheme* is configured to *sdmScheme*, the MSB of this field indicates the association between PTRS port 0 and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port 1 and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

- When one PTRS port is configured by *maxNrofPortsforSDM* in *PTRS-UplinkConfig*, SRS resource set indicator field is present and equals "10" and *multipanelScheme* is configured to *sdmScheme*, this field indicates the association between PTRS port and DMRS ports corresponding to SRS resource indicator field and Second SRS resource indicator field and/or Precoding information and number of layers field and Second Precoding information field according to Table 7.3.1.1.2-25.

- When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig,* SRS resource set indicator field is present and equals "10", *multipanelScheme* is configured to *sfnScheme*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.

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

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

- Second PTRS-DMRS association - 2 bits if PTRS-DMRS association field and SRS resource set indicator field are present and *maxRankDCI-0-2>2* and *multipanelScheme* is not configured; 0 bit otherwise. Table 7.3.1.1.2-25 and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second precoding information field when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field.

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

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

- DMRS sequence initialization - 0 or 1 bit

- 0 bit if the higher layer parameter *dmrs-SequenceInitializationDCI-0-2* is not configured, or if transform precoder is enabled by higher layers and the Transform precoder indicator field is not present;

- 1 bit if transform precoder is disabled by higher layers and the higher layer parameter *dmrs-SequenceInitializationDCI-0-2* is configured, or if the Transform precoder indicator field is present and the higher layer parameter *dmrs-SequenceInitializationDCI-0-2* is configured. If the Transform precoder indicator field is present and set to '0', the bit is reserved.

- UL-SCH indicator - 1 bit. A value of "1" indicates UL-SCH shall be transmitted on the PUSCH and a value of "0" indicates UL-SCH shall not be transmitted on the PUSCH. If a UE does not support triggering SRS only in DCI, except for DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to receive a DCI format 0\_2 with UL-SCH indicator of "0" and CSI request of all zero(s). If a UE supports triggering SRS only in DCI, except for DCI format 0\_2 with CRC scrambled by SP-CSI-RNTI, the UE is not expected to recerive a DCI format 0\_2 with UL-SCH indicator of "0", CSI request of all zero(s) and SRS request of all zero(s).

- ChannelAccess-CPext-CAPC - 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-2* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1, or the number of entries in the high layer parameter *ul-AccessConfigListDCI-0-1* foroperation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 are configured by the higher layer parameter *ul-AccessConfigListDCI-0-2* in frequency range 1*.* One or more entries from Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1* in frequency range 2-2*.*

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

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

- 1 or 2 bits otherwise,

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

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

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

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

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

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

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

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

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

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

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

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

- 0 bit, otherwise

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

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

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

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

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

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

##### 7.3.1.1.4 Format 0\_3

DCI format 0\_3 is used for the scheduling of one PUSCH in one cell, or multiple PUSCHs in multiple cells with one PUSCH per cell.

The following information is transmitted by means of the DCI format 0\_3 with CRC scrambled by C-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

- Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *MC-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *MC-DCI-SetofCellsToAddModList*.

- Scheduled cells indicator - number of bits determined by the following:

- 0 bit if the higher layer parameter *scheduledCellComboListDCI-0-3* for the scheduled cell set is not configured;

- otherwise bits indicating the scheduled cells in the scheduled cell set according to Table 7.3.1.1.4-2, where is the number of entries in the higher layer parameter *scheduledCellComboListDCI-0-3.* If only one entry is configured in the higher layer parameter *scheduledCellComboListDCI-0-3*, the scheduled cells are the cells configured by higher layer parameter *scheduledCellComboListDCI-0-3*.

- Bandwidth part indicator - 0, 1 or 2 bits determined as , where

- if , is the maximum number of UL BWPs configured by higher layers, excluding the initial UL bandwidth part, across all the cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set, 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;

The field is only applicable to a scheduled cell with the number of configured UL BWPs larger than 1, including the initial UL bandwidth part, and is applied to the applicable scheduled cells in the scheduled cell set independently. If a UE does not support active BWP change via DCI, the UE ignores this bit field. If this field indicates a code point that does not correspond to a configured BWP of a scheduled cell, the UE ignores this bit field for the scheduled cell, and operates on the active BWP of the scheduled cell.

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

- block number 1, block number 2,…, block number

If *scheduledCellComboListDCI-0-3* for the scheduled cell set is configured with more than one entry, is the number of scheduled cells indicated by Scheduled cells indicator field; if *scheduledCellComboListDCI-0-3* for the scheduled cell set is configured with only one entry, is the number of cells configured by higher layer parameter *scheduledCellComboListDCI-0-3*; otherwise, is the number of cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set. Each block corresponds to the frequency domain resource assignment for a cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the frequency domain resource assignment for the cell with the smallest serving cell index. Each block is defined by the following fields:

- 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 *resourceAllocationDCI-0-3* 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-0-3.* If the higher layer parameter *resourceAllocationType1GranularityDCI-0-3* is not configured, is equal to 1.

- If *resourceAllocationDCI-0-3* 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 *resourceAllocationDCI-0-3* 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].

If the higher layer parameter *scheduledCellComboListDCI-0-3* for the scheduled cell set is not configured, each block is also used to indicate whether the corresponding cell is scheduled or not as follows:

- if all bits of a block 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, or set to 0 for resource allocation type 2 with μ=1, or set to 1 for resource allocation type 2 with μ=0, the cell corresponding to the block is not scheduled;

- otherwise, the cell corresponding to the block is scheduled.

- Time domain resource assignment - bits, where is the number of entries in the higher layer parameter *tdra-FieldIndexListDCI-0-3*. This field is used to indicate an entry in the higher layer parameter *tdra-FieldIndexListDCI-0-3* according to Table 7.3.1.1.4-3. Each entry in the higher layer parameter *tdra-FieldIndexListDCI-0-3* contains the ‘Time domain resource assignment’ index for each BWP of each cell in the scheduled cell set, where the ‘Time domain resource assignment’ indexes for all the cells are placed according to an ascending order of a serving cell index, and the 'Time domain resource assignment' indexes for all the BWPs of a cell are placed according to an ascending order of the higher layer parameter *BWP-Id*.

- Frequency hopping flag - 0 or 1 bit

- 0 bit if the higher layer parameter *frequencyHopping* is not configured for any cell configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set;

- 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].

The field is only applicable to a scheduled cell configured with *frequencyHopping*, and is applied to the applicable scheduled cells independently.

- Modulation and coding scheme - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the modulation and coding scheme for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the modulation and coding scheme for the cell with the smallest serving cell index. Each block is 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214].

- New data indicator - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the new data indicator for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the new data indicator for the cell with the smallest serving cell index. Each block is 1 bit.

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

- block number 1, block number 2,…, block number

Each block corresponds to the redundancy version for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the redundancy version for the cell with the smallest serving cell index. Each block is 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-0-3* configured for the cell corresponding to the block,

- 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 - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the HARQ process number for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the HARQ process number for the cell with the smallest serving cell index. Each block is 0, 1, 2, 3, 4 or 5 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-0-3* configured for the cell corresponding to the block.

- 1st downlink assignment index - 1 or 2 bits

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

- 2 bits for dynamic HARQ-ACK codebook.

When two HARQ-ACK codebooks are configured for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-3* is configured, if the bit width of the 1st downlink assignment index in DCI format 0\_3 for one HARQ-ACK codebook is not equal to that of the 1st downlink assignment index in DCI format 0\_3 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\_3 for the two HARQ-ACK codebooks are the same.

- 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-0-3* is configured, if the bit width of the 2nd downlink assignment index in DCI format 0\_3 for one HARQ-ACK codebook is not equal to that of the 2nd downlink assignment index in DCI format 0\_3 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\_3 for the two HARQ-ACK codebooks are the same.

- TPC command for scheduled PUSCH - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the TPC command for the scheduled PUSCH for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the TPC command for the scheduled PUSCH for the cell with the smallest serving cell index. Each block is 2 bits as defined in Clause 7.1.1 of [5, TS38.213].

- SRS resource indicator - number of bits determined by the following:

- If *sri-DCI0-3= type1a* is configured by higher layer,

- bits applying to the scheduled cells with independently, where is the number of cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set, is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined below.

- If *sri-DCI0-3= type2* is configured by higher layer,

- block number 1, block number 2,…, block number

Each block corresponds to the SRS resource indicator for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the SRS resource indicator for the cell with the smallest serving cell index. Each block is defined below.

above for the case of *sri-DCI0-3= type1a* or each block above for the case of *sri-DCI0-3= type2* is defined by the following:

- 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 first 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 first SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList*, and associated with the higher layer parameter *usage* of value '*codeBook*'.

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

- If *tpmi-DCI0-3= type1a* is configured by higher layer,

- bits applying to the scheduled cells with independently, where is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined below.

- If *tpmi-DCI0-3= type2* is configured by higher layer,

- block number 1, block number 2,…, block number

Each block corresponds to the precoding information and number of layers for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the precoding information and number of layers for the cell with the smallest serving cell index. Each block is defined below.

above for the case of *tpmi-DCI0-3= type1a* or each block above for the case of *tpmi-DCI0-3= type2* is defined 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 value 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 value 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 value 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 value 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.

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

- If *antennaPortsDCI0-3= type1a* is configured by higher layer,

- bits applying to the scheduled cells independently, where is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined below.

- If *antennaPortsDCI0-3= type2* is configured by higher layer,

- block number 1, block number 2,…, block number

Each block corresponds to the Antenna ports information for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the Antenna ports information for the cell with the smallest serving cell index. Each block is defined below.

above for the case of *antennaPortsDCI0-3= type1a* or each block above for the case of *antennaPortsDCI0-3= type2* is defined 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 -bits, where is the number of entries in the higher layer parameter *srs-RequestListDCI-0-3*. This field is used to indicate an entry in the higher layer parameter *srs-RequestListDCI-0-3* according to Table 7.3.1.1.4-4. Each entry in the higher layer parameter *srs-RequestListDCI-0-3* contains the ‘SRS request’ index for each cell in the scheduled cell set, where the ‘SRS request’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘SRS request’ index is defined by the following:

- 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 -bits, where is the number of entries in the higher layer parameter *srs-OffsetListDCI-0-3*. This field is used to indicate an entry in the higher layer parameter *srs-OffsetListDCI-0-3* according to Table 7.3.1.1.4-5. Each entry in the higher layer parameter *srs-OffsetListDCI-0-3* contains the ‘SRS offset indicator’ index for each cell in the scheduled cell set, where the ‘SRS offset indicator’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘SRS offset indicator’ index is defined by the following:

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

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

- CSI request - 0, 1, 2, 3, 4, 5, or 6 bits determined by higher layer parameter *reportTriggerSize*. This field is applied to the cell with the smallest serving cell index among the scheduled cells indicated by Scheduled cells indicator field or Frequency domain resource assignment field.

- PTRS-DMRS association - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the PTRS-DMRS association information for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the PTRS-DMRS association information for the cell with the smallest serving cell index. Each block is defined by the following:

- 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=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.

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.

- beta\_offset indicator - 0 or 2 bits

- 0 bit if *betaOffsets = semiStatic* is configured in *uci-OnPUSCH-ListDCI-0-3* for all the cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set;

- 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-0-3* is configured, if the bit width of the beta\_offset indicator in DCI format 0\_3 for one HARQ-ACK codebook is not equal to that of the beta\_offset indicator in DCI format 0\_3 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\_3 for the two HARQ-ACK codebooks are the same.

The field is only applicable to a scheduled cell configured with *betaOffsets = dynamic* in *uci-OnPUSCH-ListDCI-0-3*, and is applied to the applicable scheduled cells independently.

- DMRS sequence initialization - 1 bit if transform precoder is disabled at least for one cell configured by higher layer parameter *ScheduledCellListDCI-0-3* in the scheduled cell set; otherwise, 0 bit.

This field is independently applied to all the scheduled cells with transform precoder disabled, and indicated by Scheduled cells indicator field or Frequency domain resource assignment field.

- 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. A UE is not expected to receive a DCI format 0\_3 with UL-SCH indicator of "0" and CSI request of all zero(s). This field is applied to the cell with the smallest serving cell index among the scheduled cells indicated by Scheduled cells indicator field or Frequency domain resource assignment field.

- ChannelAccess-CPext-CAPC -bits applying to the scheduled cells with independently, where is the number of cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set, is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined by the following:

- 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1, or for operation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1.*

- Open-loop power control parameter set indication - bits applying to the scheduled cells with independently, where is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined by the following:

- 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\_3;

- 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\_3.

- Priority indicator - 0 bit if higher layer parameter *priorityIndicatorDCI-0-3* is not configured; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213]. This field is applied to all the scheduled cells indicated by Scheduled cells indicator field or Frequency domain resource assignment field.

- Minimum applicable scheduling offset indicator - 0 or 1 bit

- 0 bit if higher layer parameter *minimumSchedulingOffsetK0DCI-0-3* is not configured;

- 1 bit otherwise. The 1 bit indication is used to determine the minimum applicable K2 for the active UL BWP and the minimum applicable K0 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 for each scheduled cell shall be the same as the minimum applicable K0.

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

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

- 0 bit if higher layer parameter *pdcchMonAdaptDCI-0-3* is not enabled;

- otherwise,

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

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

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

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

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

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

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

If *scheduledCellComboListDCI-0-3* for the cell set is configured, zeros shall be appended to DCI format 0\_3 if needed until the payload size equals the size of DCI format 0\_3 that is determined by the configuration of the corresponding active bandwidth part(s) of the scheduled cells in the entry which results in the largest size among the entries in the higher layer parameter *scheduledCellComboListDCI-0-3*.

If an SCell within the scheduled cell set is deactivated, the UE determines the bitwidth of the fields in DCI format 0\_3 based on a UL BWP provided by *firstActiveUplinkBWP-Id* for the SCell.

Table 7.3.1.1.4-1: Scheduled cell set indicator in DCI format 0\_3

|  |  |
| --- | --- |
| Bit field mapped to index | Scheduled cell set |
| 0 | The cell set configured by the 1st entry in *MC-DCI-SetofCellsToAddModList* |
| 1 | The cell set configured by the 2nd entry in *MC-DCI-SetofCellsToAddModList* |
| 2 | The cell set configured by the 3rd entry in *MC-DCI-SetofCellsToAddModList*, if any |
| 3 | The cell set configured by the 4th entry in *MC-DCI-SetofCellsToAddModList*, if any |

Table 7.3.1.1.4-2: Scheduled cells indicator in DCI format 0\_3

|  |  |
| --- | --- |
| **Bit field mapped to index** | **Scheduled cells** |
| 0 | The cells configured by the 1st entry in *scheduledCellComboListDCI-0-3* |
| 1 | The cells configured by the 2nd entry in *scheduledCellComboListDCI-0-3* |
| 2 | The cells configured by the 3rd entry in *scheduledCellComboListDCI-0-3*, if any |
| 3 | The cells configured by the 4th entry in *scheduledCellComboListDCI-0-3*, if any |
| 4 | The cells configured by the 5th entry in *scheduledCellComboListDCI-0-3*, if any |
| 5 | The cells configured by the 6th entry in *scheduledCellComboListDCI-0-3*, if any |
| 6 | The cells configured by the 7th entry in *scheduledCellComboListDCI-0-3*, if any |
| 7 | The cells configured by the 8th entry in *scheduledCellComboListDCI-0-3*, if any |
| 8 | The cells configured by the 9th entry in *scheduledCellComboListDCI-0-3*, if any |
| 9 | The cells configured by the 10th entry in *scheduledCellComboListDCI-0-3*, if any |
| 10 | The cells configured by the 11th entry in *scheduledCellComboListDCI-0-3*, if any |
| 11 | The cells configured by the 12th entry in *scheduledCellComboListDCI-0-3*, if any |
| 12 | The cells configured by the 13th entry in *scheduledCellComboListDCI-0-3*, if any |
| 13 | The cells configured by the 14th entry in *scheduledCellComboListDCI-0-3*, if any |
| 14 | The cells configured by the 15th entry in *scheduledCellComboListDCI-0-3*, if any |
| 15 | The cells configured by the 16th entry in *scheduledCellComboListDCI-0-3*, if any |

Table 7.3.1.1.4-3: Time domain resource assignment in DCI format 0\_3

|  |  |
| --- | --- |
| **Bit field mapped to index** | **Indicated time domain resource allocation** |
| 0 | The 1st entry in *tdra-FieldIndexListDCI-0-3* |
| 1 | The 2nd entry in *tdra-FieldIndexListDCI-0-3* |
| 2 | The 3rd entry in *tdra-FieldIndexListDCI-0-3*, if any |
| … | … |
|  | The entry in *tdra-FieldIndexListDCI-0-3*, if any |
| … | … |

Table 7.3.1.1.4-4: SRS request in DCI format 0\_3

|  |  |
| --- | --- |
| Bit field mapped to index | Triggered aperiodic SRS resource set(s) |
| 0 | The 1st entry in *srs-RequestListDCI-0-3* |
| 1 | The 2nd entry in *srs-RequestListDCI-0-3* |
| 2 | The 3rd entry in *srs-RequestListDCI-0-3*, if any |
| … | … |
| 15 | The 16th entry in *srs-RequestListDCI-0-3*, if any |

Table 7.3.1.1.4-5: SRS offset indicator in DCI format 0\_3

|  |  |
| --- | --- |
| Bit field mapped to index | Available slot offset |
| 0 | The 1st entry in *srs-OffsetListDCI-0-3* |
| 1 | The 2nd entry in *srs-OffsetListDCI-0-3* |
| 2 | The 3rd entry in *srs-OffsetListDCI-0-3*, if any |
| … | … |
| 7 | The 8th entry in *srs-OffsetListDCI-0-3*, if any |

#### 7.3.1.2 DCI formats for scheduling of PDSCH

##### 7.3.1.2.1 Format 1\_0

DCI format 1\_0 is used for the scheduling of PDSCH in one DL cell.

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

- Identifier for DCI formats - 1 bits

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

- Frequency domain resource assignment -  bits where  is given by Clause 7.3.1.0

If the CRC of the DCI format 1\_0 is scrambled by C-RNTI and the "Frequency domain resource assignment" field are of all ones, the DCI format 1\_0 is for random access procedure initiated by a PDCCH order, with all remaining fields set as follows:

- Random Access Preamble index - 6 bits according to *ra-PreambleIndex* in Clause 5.1.2 of [8, TS38.321]

- UL/SUL indicator - 1 bit. If the value of the "Random Access Preamble index" is not all zeros and if the UE is configured with *supplementaryUplink* in *ServingCellConfig* in the cell, this field indicates which UL carrier in the cell to transmit the PRACH according to Table 7.3.1.1.1-1; otherwise, this field is reserved

- SS/PBCH index - 6 bits. If the value of the "Random Access Preamble index" is not all zeros, this field indicates the SS/PBCH that shall be used to determine the RACH occasion for the PRACH transmission; otherwise, this field is reserved.

- PRACH Mask index - 4 bits. If the value of the "Random Access Preamble index" is not all zeros, this field indicates the RACH occasion associated with the SS/PBCH indicated by "SS/PBCH index" for the PRACH transmission, according to Clause 5.1.1 of [8, TS38.321]; otherwise, this field is reserved

- Cell indicator - bits indicating the cell for the corresponding PRACH transmission if the UE is configured with higher layer parameter *EarlyUlSyncConfig*, where *C* is the number of candidate cells configured with higher layer parameter *EarlyUlSyncConfig*; 0 bit otherwise. The bit field index 0 of the cell indicator field is mapped to the serving cell, and other bit field indexes are mapped to the candidate cells configured with higher layer parameter *EarlyUlSyncConfig* according to an ascending order of a candidate identity configured by *ltm-CandidateId*, with the bit field index 1 mapped to the candidate cell with the smallest candidate identity.

- PRACH association indicator - 0 or 1 bit

- 1bit if the UE is provided with *tag-Id2*, and the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs.

- This field indicates the PCI associated with the PRACH transmission if the UE is provided *SSB-MTC-AddtionalPCI*. The bit field index 0 of this field is mapped to the PCI of the serving cell, and the bit field index 1 of this field is mapped to the additional PCI associated with active TCI states.

- This field indicates the PL-RS for the PRACH transmission if the UE is not provided *SSB-MTC-AddtionalPCI*. The bit field index 0 of this field is mapped to the DL RS that the DM-RS of the PDCCH order is quasi-collocated with, and the bit field index 1 of this field is mapped to the SS/PBCH indicated by the SS/PBCH index field in this DCI format.

- 0 bit otherwise.

- PRACH retransmission indicator - 0 or 1 bit

- 1bit if the UE is configured with higher layer parameter *EarlyUlSyncConfig*. This field indicates initial transmission or retransmission of PRACH according to Table 7.3.1.2.1-3 if the cell indicated by Cell indicator field is a candidate cell, and this field is reserved if the cell indicated by Cell indicator field is a serving cell but not a candidate cell.

- 0 bit otherwise.

- Reserved bits - a number of bits as determined by the following:

- (12 - - ) bits for operation in a cell with shared spectrum channel access in frequency range 1 or when the DCI format is monitored in common search space for operation in a cell in frequency range 2-2;

- (10 - - ) bits otherwise;

where,

- if the UE is not configured with higher layer parameter *EarlyUlSyncConfig*; +1 otherwise.

- if the "PRACH association indicator" field is not present in this DCI format; otherwise.

Otherwise, all remaining fields are set as follows:

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS 38.214]

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits

- Downlink assignment index - 2 bits as defined in Clause 9.1.3 of [5, TS 38.213], as counter DAI

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

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

- PDSCH-to-HARQ\_feedback timing indicator - 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- ChannelAccess-CPext - 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1; 2 bits indicating channel access type as defined in Table 7.3.1.1.1-4B if *ChannelAccessMode2-r17* is provided for operation in a cell in frequency range 2-2; 0 bits otherwise

- Reserved bits - 2 bits when the DCI format is monitored in common search space for operation in a cell in frequency range 2-2 and the number of bits for the field of 'ChannelAccess-CPext' is 0; 0 bits otherwise

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by P-RNTI:

- Short Messages Indicator - 2 bits according to Table 7.3.1.2.1-1.

- Short Messages - 8 bits, according to Clause 6.5 of [9, TS38.331]. If only the scheduling information for Paging, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

- Frequency domain resource assignment - bits. If only the short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

-  is the size of CORESET 0

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]. If only the short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5. If only the short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214], using Table 5.1.3.1-1. If only the short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

- TB scaling - 2 bits as defined in Clause 5.1.3.2 of [6, TS38.214]. If only the short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are carried, this bit field is reserved.

- TRS availability indication - 1, 2, 3, 4, 5, or 6 bits, where the number of bits is equal to one plus the highest value of all the *indBitID*(s) provided by the *trs-ResourceSetConfig* if configured; 0 bits otherwise.

- Reserved bits - (8 - *M*) bits for operation in a cell with shared spectrum channel access in frequency range 1 or for operation in a cell in frequency range 2-2; (6 - *M*) bits for operation in a cell without shared spectrum channel access, where the value of *M* is the number of bits for the field of 'TRS availability indication' as defined above.

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by SI-RNTI:

- Frequency domain resource assignment - bits

-  is the size of CORESET 0

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214], using Table 5.1.3.1-1

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- System information indicator - 1 bit as defined in Table 7.3.1.2.1-2

- Reserved bits - 17 bits for operation in a cell with shared spectrum channel access in frequency range 1 or for operation in a cell in frequency range 2-2; otherwise 15 bits

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by RA-RNTI or MsgB-RNTI:

- Frequency domain resource assignment - bits

-  is the size of CORESET 0 if CORESET 0 is configured for the cell and  is the size of initial DL bandwidth part if CORESET 0 is not configured for the cell

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214], using Table 5.1.3.1-1

- TB scaling - 2 bits as defined in Clause 5.1.3.2 of [6, TS38.214]

- LSBs of SFN - 2 bits for the DCI format 1\_0 with CRC scrambled by MsgB-RNTI as defined in Clause 8.2A of [5, TS 38.213] if *msgB-responseWindow* is configured to be larger than 10 ms; or 2 bits for the DCI format 1\_0 with CRC scrambled by RA-RNTI as defined in Clause 8.2 of [5, TS 38.213] for operation in a cell with shared spectrum channel access if *ra-ResponseWindow or ra-ResponseWindow-v1610* is configured to be larger than 10 ms; 0 bit otherwise

- Reserved bits - (16 - *A*) bits for operation in a cell without shared spectrum access in frequency range 1 and frequency range 2-1, (18 - *A*) for operation in a cell with shared spectrum access in frequency range 1 or for operation in a cell in frequency range 2-2, where the value of *A* is the number of bits for the field of 'LSBs of SFN' as defined above

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by TC-RNTI:

- Identifier for DCI formats - 1 bit

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

- Frequency domain resource assignment - bits

-  is the size of CORESET 0

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214], using Table 5.1.3.1-1

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits

- Downlink assignment index - 2 bits

- 2 bits indicating the number of repetitions for PUCCH as defined in clause 9.2.6 of [5, TS38.213] according to Table 7.3.1.2.1-4, if the higher layer parameter *numberOfPUCCHforMsg4HARQACK-RepetitionsList* is configured with at least two values and the UE has indicated capability of PUCCH repetition on common PUCCH resource [8, TS38.321];

- otherwise, reserved.

- TPC command for scheduled PUCCH - 2 bits as defined in Clause 7.2.1 of [5, TS38.213]

- PUCCH resource indicator - 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- PDSCH-to-HARQ\_feedback timing indicator - 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- ChannelAccess-CPext - 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1; 2 bits indicating channel access type as defined in Table 7.3.1.1.1-4B if *ChannelAccessMode2-r17* is provided for operation in a cell in frequency range 2-2; otherwise 0 bit

- Reserved bits - 2 bits when the DCI format is monitored in common search space for operation in a cell in frequency range 2-2 and the number of bits for the field of 'ChannelAccess-CPext' is 0; 0 bits otherwise

Table 7.3.1.2.1-1: Short Message indicator

|  |  |
| --- | --- |
| Bit field | Short Message indicator |
| 00 | Reserved |
| 01 | Only scheduling information for Paging, and TRS availability indication if *trs-ResourceSetConfig* is configured, are present in the DCI |
| 10 | Only short message, and TRS availability indication if *trs-ResourceSetConfig* is configured, are present in the DCI |
| 11 | Both scheduling information for Paging, TRS availability indication if *trs-ResourceSetConfig* is configured and short message are present in the DCI |

Table 7.3.1.2.1-2: System information indicator

|  |  |
| --- | --- |
| Bit field | System information indicator |
| 0 | SIB1 [9, TS38.331, Clause 5.2.1] |
| 1 | SI message [9, TS38.331, Clause 5.2.1] |

Table 7.3.1.2.1-3: PRACH retransmission indicator

|  |  |
| --- | --- |
| Bit field | PRACH retransmission indicator |
| 0 | Initial transmission of PRACH |
| 1 | Retransmission of PRACH |

Table 7.3.1.2.1-4: Number of repetitions as a function of 2 bits of Downlink assignment index field

|  |  |
| --- | --- |
| **Bit field** |  |
| 00 | First value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* |
| 01 | Second value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* |
| 10 | Third value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* if provided, otherwise reserved |
| 11 | Fourth value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* if provided, otherwise reserved |

##### 7.3.1.2.2 Format 1\_1

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

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

- Identifier for DCI formats - 1 bits

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

- Carrier indicator - 0 or 3 bits as defined in Clause 10.1 of [5, TS 38.213]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

- Bandwidth part indicator - 0, 1 or 2 bits as determined by the number of DL BWPs  configured by higher layers, excluding the initial DL 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 DL bandwidth part:

-  bits if only resource allocation type 0 is configured, where  is defined in Clause 5.1.2.2.1 of [6, TS38.214],

- 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 5.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the  LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 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.

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

- If the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH* is not configured and if the higher layer parameter *pdsch-TimeDomainAllocationList* is configured, 0, 1, 2, 3 or 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationList* if the higher layer parameter is configured;

- if the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH* is configured, 0, 1, 2, 3, 4, 5 or 6 bits as defined in Clause 5.1.2.1 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 *pdsch-TimeDomainAllocationListForMultiPDSCH*;

- otherwise *I* is the number of entries in the default table.

- VRB-to-PRB mapping - 0 or 1 bit:

- 0 bit if only resource allocation type 0 is configured or if interleaved VRB-to-PRB mapping is not configured by high layers;

- 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].

- PRB bundling size indicator - 0 bit if the higher layer parameter *prb-BundlingType* is not configured or is set to 'staticBundling', or 1 bit if the higher layer parameter *prb-BundlingType* is set to 'dynamicBundling' according to Clause 5.1.2.3 of [6, TS 38.214].

- Rate matching indicator - 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2*, where the MSB is used to indicate *rateMatchPatternGroup1* and the LSB is used to indicate *rateMatchPatternGroup2* when there are two groups.

- ZP CSI-RS trigger - 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured by higher layer.

For transport block 1:

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator - 1 bit if the number of scheduled PDSCH 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 PDSCH among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, where each bit corresponds to one scheduled PDSCH as defined in clause 5.1.3 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 PDSCH 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 PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, where each bit corresponds to one scheduled PDSCH as defined in clause 5.1.3 in [6, TS 38.214] and redundancy version is determined according to Table 7.3.1.1.2-34.

For transport block 2 (only present if *maxNrofCodeWordsScheduledByDCI* equals 2):

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator - 1 bit if the number of scheduled PDSCH 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 PDSCH among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, where each bit corresponds to one scheduled PDSCH as defined in clause 5.1.3 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 PDSCH 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 PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, where each bit corresponds to one scheduled PDSCH as defined in clause 5.1.3 in [6, TS 38.214] and redundancy version is determined according to Table 7.3.1.1.2-34.

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and the value of *maxNrofCodeWordsScheduledByDCI* for the indicated bandwidth part equals 2 and the value of *maxNrofCodeWordsScheduledByDCI* for the active bandwidth part equals 1, the UE assumes zeros are padded when interpreting the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields of transport block 2 according to Clause 12 of [5, TS38.213], and the UE ignores the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields of transport block 2 for the indicated bandwidth part.

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

- Downlink assignment index - number of bits as defined in the following

- 6 bits if more than one serving cell are configured in the DL and the higher layer parameter *nfi-TotalDAI-Included* is configured. The 4 MSB bits are the counter DAI and the total DAI for the scheduled PDSCH group, and the 2 LSB bits are the total DAI for the non-scheduled PDSCH group.

- 4 bits if only one serving cell is configured in the DL and the higher layer parameter *nfi-TotalDAI-Included* is configured*.* The 2 MSB bits are the counter DAI for the scheduled PDSCH group, and the 2 LSB bits are the total DAI for the non-scheduled PDSCH group;

- 4 bits if more than one serving cell are configured in the DL, the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic* or *pdsch-HARQ-ACK-Codebook-r16= enhancedDynamic*, and *nfi-TotalDAI-Included* is not configured, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI;

- 4 bits if one serving cell is configured in the DL, and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, and the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode = joint*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI;

- 2 bits if only one serving cell is configured in the DL, the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic* or *pdsch-HARQ-ACK-Codebook-r16=enhancedDynamic*, and *nfi-TotalDAI-Included* is not configured, when the UE is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided or the UE is not configured with *ackNackFeedbackMode = joint*, where the 2 bits are the counter DAI;

- 0 bits otherwise.

If the UE is configured with a PUCCH-SCell, the number of serving cells is determined within a PUCCH group.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* if present for the secondary PUCCH group.

If higher layer parameter *priorityIndicatorDCI-1-1* is configured, if the bit width of the Downlink assignment index in DCI format 1\_1 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index 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 Downlink assignment index until the bit width of the Downlink assignment index in DCI format 1\_1 for the two HARQ-ACK codebooks are the same.

- 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 on the same cell for PUCCH transmission, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_1 for the two HARQ-ACK codebooks are the same.

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

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

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

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedback-r16* or *pdsch-HARQ-ACK-EnhType3ToAddModList* is configured;

- 0 bit otherwise.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* for the secondary PUCCH group*.*

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

- 0 bit if *pdsch-HARQ-ACK-EnhType3DCI-Field* is not configured;

- bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-EnhType3ToAddModList.*

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3DCI-Field* is replaced by *pdsch-HARQ-ACK-EnhType3DCI-FieldSecondaryPUCCHgroup* for the secondary PUCCH group, and *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryList* for the secondary PUCCH group*.*

- PDSCH group index - 0 or 1 bit.

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

- 0 bit otherwise.

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

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

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

- 0 bit otherwise.

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

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

- 0 bit otherwise.

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

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

- 0 bit otherwise.

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

- Antenna port(s) - 4, 5, 6, 7 or 8 bits as defined by Tables 7.3.1.2.2-1/2/3/4/7/8/9/10 and Tables 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A, 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 7.3.1.2.2-1/2/3/4/7/8/9/10 or Tables 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A. When a UE not configured with *dl-OrJointTCI-StateList* receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, or when a UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4/7/8/9/10. The UE can receive an entry with DMRS ports equals to 1000, 1002, 1003 when two the UE is not configured with *dl-OrJointTCI-StateList* and TCI states are indicated in a codepoint of DCI field '*Transmission Configuration Indication*', or when the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI states to be applied to PDSCH.

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.

- TCI selection - 0 bit if higher layer parameter *tciSelection-PresentInDCI* is not configured; otherwise 2 bits according to Table 7.3.1.2.2-11.

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

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

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

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

- CBG transmission information (CBGTI) - 0 bit if higher layer parameter *PDSCH-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 in frequency range 1, or for operation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 or Table 7.3.1.2.2-6A 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 the number of different *DormancyGroupID(s)* provided by higher layer parameter *dormancyGroupWithinActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupWithinActiveTime,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group in ascending order of *DormancyGroupID*. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an SCell.

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

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

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

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

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

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

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

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

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

- 0 bit, otherwise

- PUCCH Cell indicator - 0 or 1 bit.

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

- 0 bit otherwise.

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

- Co-scheduled UE information – 0 or 3 bits

- 3 bits as defined in Table 7.3.1.2.2-12 if higher layer parameter *XYZ* is configured. This field is reserved if two codewords are scheduled by this DCI format 1\_1.

- 0 bit otherwise.

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

If the number of information bits in DCI format 1\_1 scheduling a single PDSCH prior to padding is not equal to the number of information bits in DCI format 1\_1 scheduling multiple PDSCHs for the same serving cell, zeros shall be appended to the DCI format 1\_1 with smaller size until the payload size is the same for scheduling a single PDSCH and multiple PDSCHs.

For a UE configured with scheduling on the primary cell from an SCell, if prior to padding the number of information bits in DCI format 1\_1 carried by PDCCH on the primary cell is not equal to the number of information bits in DCI format 1\_1 carried by PDCCH on the SCell for scheduling on the primary cell, zeros shall be appended to the DCI format 1\_1 with smaller size until the payload size is the same:

- If application of step 4C in clause 7.3.1.0 results in additional zero padding for DCI format 1\_1 for scheduling on the primary cell, corresponding zeros shall be appended to both DCI format 1\_1 monitored on the primary cell and DCI format 1\_1 monitored on the SCell for scheduling on the primary cell.

- If the SCell is deactivated and *firstActiveDownlinkBWP-Id* is not set to dormant BWP, the UE determines the number of information bits in DCI format 1\_1 carried by PDCCH on the primary cell based on a DL BWP provided by *firstActiveDownlinkBWP-Id* for the SCell. If the active DL BWP of the SCell is a dormant DL BWP, or if the SCell is deactivated and *firstActiveDownlinkBWP-Id* is set to dormant BWP, the UE determines the number of information bits in DCI format 1\_1 carried by PDCCH on the primary cell based on a DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided; otherwise, based on a DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.

Table 7.3.1.2.2-1: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1, *maxLength*=1

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

Table 7.3.1.2.2-1A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1, *maxLength*=1

|  |  |  |
| --- | --- | --- |
| **One Codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| 2 | 1 | 0,1 |
| 3 | 2 | 0 |
| 4 | 2 | 1 |
| 5 | 2 | 2 |
| 6 | 2 | 3 |
| 7 | 2 | 0,1 |
| 8 | 2 | 2,3 |
| 9 | 2 | 0-2 |
| 10 | 2 | 0-3 |
| 11 | 2 | 0,2 |
| 12 | 2 | 0,2,3 |
| 13-15 | Reserved | Reserved |

Table 7.3.1.2.2-2: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1, *maxLength*=2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **One Codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 2 | 0-4 | 2 |
| 1 | 1 | 1 | 1 | 1 | 2 | 0,1,2,3,4,6 | 2 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,4,5,6 | 2 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,4,5,6,7 | 2 |
| 4 | 2 | 1 | 1 | 4-31 | reserved | reserved | reserved |
| 5 | 2 | 2 | 1 |  |  |  |  |
| 6 | 2 | 3 | 1 |  |  |  |  |
| 7 | 2 | 0,1 | 1 |  |  |  |  |
| 8 | 2 | 2,3 | 1 |  |  |  |  |
| 9 | 2 | 0-2 | 1 |  |  |  |  |
| 10 | 2 | 0-3 | 1 |  |  |  |  |
| 11 | 2 | 0,2 | 1 |  |  |  |  |
| 12 | 2 | 0 | 2 |  |  |  |  |
| 13 | 2 | 1 | 2 |  |  |  |  |
| 14 | 2 | 2 | 2 |  |  |  |  |
| 15 | 2 | 3 | 2 |  |  |  |  |
| 16 | 2 | 4 | 2 |  |  |  |  |
| 17 | 2 | 5 | 2 |  |  |  |  |
| 18 | 2 | 6 | 2 |  |  |  |  |
| 19 | 2 | 7 | 2 |  |  |  |  |
| 20 | 2 | 0,1 | 2 |  |  |  |  |
| 21 | 2 | 2,3 | 2 |  |  |  |  |
| 22 | 2 | 4,5 | 2 |  |  |  |  |
| 23 | 2 | 6,7 | 2 |  |  |  |  |
| 24 | 2 | 0,4 | 2 |  |  |  |  |
| 25 | 2 | 2,6 | 2 |  |  |  |  |
| 26 | 2 | 0,1,4 | 2 |  |  |  |  |
| 27 | 2 | 2,3,6 | 2 |  |  |  |  |
| 28 | 2 | 0,1,4,5 | 2 |  |  |  |  |
| 29 | 2 | 2,3,6,7 | 2 |  |  |  |  |
| 30 | 2 | 0,2,4,6 | 2 |  |  |  |  |
| 31 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-2A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1, *maxLength*=2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **One Codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 2 | 0-4 | 2 |
| 1 | 1 | 1 | 1 | 1 | 2 | 0,1,2,3,4,6 | 2 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,4,5,6 | 2 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,4,5,6,7 | 2 |
| 4 | 2 | 1 | 1 | 4-31 | reserved | reserved | reserved |
| 5 | 2 | 2 | 1 |  |  |  |  |
| 6 | 2 | 3 | 1 |  |  |  |  |
| 7 | 2 | 0,1 | 1 |  |  |  |  |
| 8 | 2 | 2,3 | 1 |  |  |  |  |
| 9 | 2 | 0-2 | 1 |  |  |  |  |
| 10 | 2 | 0-3 | 1 |  |  |  |  |
| 11 | 2 | 0,2 | 1 |  |  |  |  |
| 12 | 2 | 0 | 2 |  |  |  |  |
| 13 | 2 | 1 | 2 |  |  |  |  |
| 14 | 2 | 2 | 2 |  |  |  |  |
| 15 | 2 | 3 | 2 |  |  |  |  |
| 16 | 2 | 4 | 2 |  |  |  |  |
| 17 | 2 | 5 | 2 |  |  |  |  |
| 18 | 2 | 6 | 2 |  |  |  |  |
| 19 | 2 | 7 | 2 |  |  |  |  |
| 20 | 2 | 0,1 | 2 |  |  |  |  |
| 21 | 2 | 2,3 | 2 |  |  |  |  |
| 22 | 2 | 4,5 | 2 |  |  |  |  |
| 23 | 2 | 6,7 | 2 |  |  |  |  |
| 24 | 2 | 0,4 | 2 |  |  |  |  |
| 25 | 2 | 2,6 | 2 |  |  |  |  |
| 26 | 2 | 0,1,4 | 2 |  |  |  |  |
| 27 | 2 | 2,3,6 | 2 |  |  |  |  |
| 28 | 2 | 0,1,4,5 | 2 |  |  |  |  |
| 29 | 2 | 2,3,6,7 | 2 |  |  |  |  |
| 30 | 2 | 0,2,4,6 | 2 |  |  |  |  |
| 31 | 2 | 0,2,3 | 1 |  |  |  |  |

Table 7.3.1.2.2-3: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2, *maxLength*=1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | **Two codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0 | 0 | 3 | 0-4 |
| 1 | 1 | 1 | 1 | 3 | 0-5 |
| 2 | 1 | 0,1 | 2-31 | reserved | reserved |
| 3 | 2 | 0 |  |  |  |
| 4 | 2 | 1 |  |  |  |
| 5 | 2 | 2 |  |  |  |
| 6 | 2 | 3 |  |  |  |
| 7 | 2 | 0,1 |  |  |  |
| 8 | 2 | 2,3 |  |  |  |
| 9 | 2 | 0-2 |  |  |  |
| 10 | 2 | 0-3 |  |  |  |
| 11 | 3 | 0 |  |  |  |
| 12 | 3 | 1 |  |  |  |
| 13 | 3 | 2 |  |  |  |
| 14 | 3 | 3 |  |  |  |
| 15 | 3 | 4 |  |  |  |
| 16 | 3 | 5 |  |  |  |
| 17 | 3 | 0,1 |  |  |  |
| 18 | 3 | 2,3 |  |  |  |
| 19 | 3 | 4,5 |  |  |  |
| 20 | 3 | 0-2 |  |  |  |
| 21 | 3 | 3-5 |  |  |  |
| 22 | 3 | 0-3 |  |  |  |
| 23 | 2 | 0,2 |  |  |  |
| 24-31 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-3A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2, *maxLength*=1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | **Two codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** |
| 0 | 1 | 0 | 0 | 3 | 0-4 |
| 1 | 1 | 1 | 1 | 3 | 0-5 |
| 2 | 1 | 0,1 | 2-31 | reserved | reserved |
| 3 | 2 | 0 |  |  |  |
| 4 | 2 | 1 |  |  |  |
| 5 | 2 | 2 |  |  |  |
| 6 | 2 | 3 |  |  |  |
| 7 | 2 | 0,1 |  |  |  |
| 8 | 2 | 2,3 |  |  |  |
| 9 | 2 | 0-2 |  |  |  |
| 10 | 2 | 0-3 |  |  |  |
| 11 | 3 | 0 |  |  |  |
| 12 | 3 | 1 |  |  |  |
| 13 | 3 | 2 |  |  |  |
| 14 | 3 | 3 |  |  |  |
| 15 | 3 | 4 |  |  |  |
| 16 | 3 | 5 |  |  |  |
| 17 | 3 | 0,1 |  |  |  |
| 18 | 3 | 2,3 |  |  |  |
| 19 | 3 | 4,5 |  |  |  |
| 20 | 3 | 0-2 |  |  |  |
| 21 | 3 | 3-5 |  |  |  |
| 22 | 3 | 0-3 |  |  |  |
| 23 | 2 | 0,2 |  |  |  |
| 24 | 2 | 0,2,3 |  |  |  |
| 25-31 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-4: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2, *maxLength*=2

| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 3 | 0-4 | 1 |
| 1 | 1 | 1 | 1 | 1 | 3 | 0-5 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,6 | 2 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,6,8 | 2 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0,1,2,3,6,7,8 | 2 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0,1,2,3,6,7,8,9 | 2 |
| 6 | 2 | 3 | 1 | 6-63 | Reserved | Reserved | Reserved |
| 7 | 2 | 0,1 | 1 |  |  |  |  |
| 8 | 2 | 2,3 | 1 |  |  |  |  |
| 9 | 2 | 0-2 | 1 |  |  |  |  |
| 10 | 2 | 0-3 | 1 |  |  |  |  |
| 11 | 3 | 0 | 1 |  |  |  |  |
| 12 | 3 | 1 | 1 |  |  |  |  |
| 13 | 3 | 2 | 1 |  |  |  |  |
| 14 | 3 | 3 | 1 |  |  |  |  |
| 15 | 3 | 4 | 1 |  |  |  |  |
| 16 | 3 | 5 | 1 |  |  |  |  |
| 17 | 3 | 0,1 | 1 |  |  |  |  |
| 18 | 3 | 2,3 | 1 |  |  |  |  |
| 19 | 3 | 4,5 | 1 |  |  |  |  |
| 20 | 3 | 0-2 | 1 |  |  |  |  |
| 21 | 3 | 3-5 | 1 |  |  |  |  |
| 22 | 3 | 0-3 | 1 |  |  |  |  |
| 23 | 2 | 0,2 | 1 |  |  |  |  |
| 24 | 3 | 0 | 2 |  |  |  |  |
| 25 | 3 | 1 | 2 |  |  |  |  |
| 26 | 3 | 2 | 2 |  |  |  |  |
| 27 | 3 | 3 | 2 |  |  |  |  |
| 28 | 3 | 4 | 2 |  |  |  |  |
| 29 | 3 | 5 | 2 |  |  |  |  |
| 30 | 3 | 6 | 2 |  |  |  |  |
| 31 | 3 | 7 | 2 |  |  |  |  |
| 32 | 3 | 8 | 2 |  |  |  |  |
| 33 | 3 | 9 | 2 |  |  |  |  |
| 34 | 3 | 10 | 2 |  |  |  |  |
| 35 | 3 | 11 | 2 |  |  |  |  |
| 36 | 3 | 0,1 | 2 |  |  |  |  |
| 37 | 3 | 2,3 | 2 |  |  |  |  |
| 38 | 3 | 4,5 | 2 |  |  |  |  |
| 39 | 3 | 6,7 | 2 |  |  |  |  |
| 40 | 3 | 8,9 | 2 |  |  |  |  |
| 41 | 3 | 10,11 | 2 |  |  |  |  |
| 42 | 3 | 0,1,6 | 2 |  |  |  |  |
| 43 | 3 | 2,3,8 | 2 |  |  |  |  |
| 44 | 3 | 4,5,10 | 2 |  |  |  |  |
| 45 | 3 | 0,1,6,7 | 2 |  |  |  |  |
| 46 | 3 | 2,3,8,9 | 2 |  |  |  |  |
| 47 | 3 | 4,5,10,11 | 2 |  |  |  |  |
| 48 | 1 | 0 | 2 |  |  |  |  |
| 49 | 1 | 1 | 2 |  |  |  |  |
| 50 | 1 | 6 | 2 |  |  |  |  |
| 51 | 1 | 7 | 2 |  |  |  |  |
| 52 | 1 | 0,1 | 2 |  |  |  |  |
| 53 | 1 | 6,7 | 2 |  |  |  |  |
| 54 | 2 | 0,1 | 2 |  |  |  |  |
| 55 | 2 | 2,3 | 2 |  |  |  |  |
| 56 | 2 | 6,7 | 2 |  |  |  |  |
| 57 | 2 | 8,9 | 2 |  |  |  |  |
| 58-63 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-4A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2, *maxLength*=2

| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 3 | 0-4 | 1 |
| 1 | 1 | 1 | 1 | 1 | 3 | 0-5 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,6 | 2 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,6,8 | 2 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0,1,2,3,6,7,8 | 2 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0,1,2,3,6,7,8,9 | 2 |
| 6 | 2 | 3 | 1 | 6-63 | Reserved | Reserved | Reserved |
| 7 | 2 | 0,1 | 1 |  |  |  |  |
| 8 | 2 | 2,3 | 1 |  |  |  |  |
| 9 | 2 | 0-2 | 1 |  |  |  |  |
| 10 | 2 | 0-3 | 1 |  |  |  |  |
| 11 | 3 | 0 | 1 |  |  |  |  |
| 12 | 3 | 1 | 1 |  |  |  |  |
| 13 | 3 | 2 | 1 |  |  |  |  |
| 14 | 3 | 3 | 1 |  |  |  |  |
| 15 | 3 | 4 | 1 |  |  |  |  |
| 16 | 3 | 5 | 1 |  |  |  |  |
| 17 | 3 | 0,1 | 1 |  |  |  |  |
| 18 | 3 | 2,3 | 1 |  |  |  |  |
| 19 | 3 | 4,5 | 1 |  |  |  |  |
| 20 | 3 | 0-2 | 1 |  |  |  |  |
| 21 | 3 | 3-5 | 1 |  |  |  |  |
| 22 | 3 | 0-3 | 1 |  |  |  |  |
| 23 | 2 | 0,2 | 1 |  |  |  |  |
| 24 | 3 | 0 | 2 |  |  |  |  |
| 25 | 3 | 1 | 2 |  |  |  |  |
| 26 | 3 | 2 | 2 |  |  |  |  |
| 27 | 3 | 3 | 2 |  |  |  |  |
| 28 | 3 | 4 | 2 |  |  |  |  |
| 29 | 3 | 5 | 2 |  |  |  |  |
| 30 | 3 | 6 | 2 |  |  |  |  |
| 31 | 3 | 7 | 2 |  |  |  |  |
| 32 | 3 | 8 | 2 |  |  |  |  |
| 33 | 3 | 9 | 2 |  |  |  |  |
| 34 | 3 | 10 | 2 |  |  |  |  |
| 35 | 3 | 11 | 2 |  |  |  |  |
| 36 | 3 | 0,1 | 2 |  |  |  |  |
| 37 | 3 | 2,3 | 2 |  |  |  |  |
| 38 | 3 | 4,5 | 2 |  |  |  |  |
| 39 | 3 | 6,7 | 2 |  |  |  |  |
| 40 | 3 | 8,9 | 2 |  |  |  |  |
| 41 | 3 | 10,11 | 2 |  |  |  |  |
| 42 | 3 | 0,1,6 | 2 |  |  |  |  |
| 43 | 3 | 2,3,8 | 2 |  |  |  |  |
| 44 | 3 | 4,5,10 | 2 |  |  |  |  |
| 45 | 3 | 0,1,6,7 | 2 |  |  |  |  |
| 46 | 3 | 2,3,8,9 | 2 |  |  |  |  |
| 47 | 3 | 4,5,10,11 | 2 |  |  |  |  |
| 48 | 1 | 0 | 2 |  |  |  |  |
| 49 | 1 | 1 | 2 |  |  |  |  |
| 50 | 1 | 6 | 2 |  |  |  |  |
| 51 | 1 | 7 | 2 |  |  |  |  |
| 52 | 1 | 0,1 | 2 |  |  |  |  |
| 53 | 1 | 6,7 | 2 |  |  |  |  |
| 54 | 2 | 0,1 | 2 |  |  |  |  |
| 55 | 2 | 2,3 | 2 |  |  |  |  |
| 56 | 2 | 6,7 | 2 |  |  |  |  |
| 57 | 2 | 8,9 | 2 |  |  |  |  |
| 58 | 2 | 0,2,3 | 1 |  |  |  |  |
| 59-63 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-5: VRB-to-PRB mapping

|  |  |
| --- | --- |
| **Bit field mapped to index** | **VRB-to-PRB mapping** |
| 0 | Non-interleaved |
| 1 | Interleaved |

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

|  |  |  |
| --- | --- | --- |
| **Entry index** | **Channel Access Type** | **The CP extension Text index defined in Clause 5.3.1 of [4,TS 38.211]** |
| 0 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 |
| 1 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 |
| 2 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 |
| 3 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 |
| 4 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 |
| 5 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 |
| 6 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 |
| 7 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 |
| 8 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 |
| 9 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 |
| 10 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 |

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

|  |  |
| --- | --- |
| **Entry index** | **Channel Access Type** |
| 0 | Type 1 channel access defined in clause 4.4.1 of TS 37.213 [14] |
| 1 | Type 2 channel access defined in clause 4.4.2 of TS 37.213 [14] |
| 2 | Type 3 channel access defined in clause 4.4.3 of TS 37.213 [14] |

Table 7.3.1.2.2-7: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=1

| One Codeword:  Codeword 0 enabled,  Codeword 1 disabled | | | Two Codewords:  Codeword 0 enabled,  Codeword 1 enabled | | |
| --- | --- | --- | --- | --- | --- |
| Value | Number of DMRS CDM group(s) without data | DMRS port(s) | Value | Number of DMRS CDM group(s) without data | DMRS port(s) |
| 0 | 1 | 0 | 0 | 2 | 0,1,2,3,8 |
| 1 | 1 | 1 | 1 | 2 | 0,1,2,3,8,10 |
| 2 | 1 | 0,1 | 2 | 2 | 0,1,2,3,8,9,10 |
| 3 | 2 | 0 | 3 | 2 | 0,1,2,3,8,9,10,11 |
| 4 | 2 | 1 | 4-31 | Reserved | Reserved |
| 5 | 2 | 2 |  |  |  |
| 6 | 2 | 3 |  |  |  |
| 7 | 2 | 0,1 |  |  |  |
| 8 | 2 | 2,3 |  |  |  |
| 9 | 2 | 0-2 |  |  |  |
| 10 | 2 | 0-3 |  |  |  |
| 11 | 2 | 0,2 |  |  |  |
| 12 | 1 | 8 |  |  |  |
| 13 | 1 | 9 |  |  |  |
| 14 | 1 | 8,9 |  |  |  |
| 15 | 2 | 8 |  |  |  |
| 16 | 2 | 9 |  |  |  |
| 17 | 2 | 10 |  |  |  |
| 18 | 2 | 11 |  |  |  |
| 19 | 2 | 8,9 |  |  |  |
| 20 | 2 | 10,11 |  |  |  |
| 21 | 1 | 0,1,8 |  |  |  |
| 22 | 1 | 0,1,8,9 |  |  |  |
| 23 | 2 | 0,1,8 |  |  |  |
| 24 | 2 | 0,1,8,9 |  |  |  |
| 25 | 2 | 2,3,10 |  |  |  |
| 26 | 2 | 2,3,10,11 |  |  |  |
| 27-31 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-7A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=1

| One Codeword:  Codeword 0 enabled,  Codeword 1 disabled | | | Two Codewords:  Codeword 0 enabled,  Codeword 1 enabled | | |
| --- | --- | --- | --- | --- | --- |
| Value | Number of DMRS CDM group(s) without data | DMRS port(s) | Value | Number of DMRS CDM group(s) without data | DMRS port(s) |
| 0 | 1 | 0 | 0 | 2 | 0,1,2,3,8 |
| 1 | 1 | 1 | 1 | 2 | 0,1,2,3,8,10 |
| 2 | 1 | 0,1 | 2 | 2 | 0,1,2,3,8,9,10 |
| 3 | 2 | 0 | 3 | 2 | 0,1,2,3,8,9,10,11 |
| 4 | 2 | 1 | 4-31 | Reserved | Reserved |
| 5 | 2 | 2 |  |  |  |
| 6 | 2 | 3 |  |  |  |
| 7 | 2 | 0,1 |  |  |  |
| 8 | 2 | 2,3 |  |  |  |
| 9 | 2 | 0-2 |  |  |  |
| 10 | 2 | 0-3 |  |  |  |
| 11 | 2 | 0,2 |  |  |  |
| 12 | 1 | 8 |  |  |  |
| 13 | 1 | 9 |  |  |  |
| 14 | 1 | 8,9 |  |  |  |
| 15 | 2 | 8 |  |  |  |
| 16 | 2 | 9 |  |  |  |
| 17 | 2 | 10 |  |  |  |
| 18 | 2 | 11 |  |  |  |
| 19 | 2 | 8,9 |  |  |  |
| 20 | 2 | 10,11 |  |  |  |
| 21 | 1 | 0,1,8 |  |  |  |
| 22 | 1 | 0,1,8,9 |  |  |  |
| 23 | 2 | 0,1,8 |  |  |  |
| 24 | 2 | 0,1,8,9 |  |  |  |
| 25 | 2 | 2,3,10 |  |  |  |
| 26 | 2 | 2,3,10,11 |  |  |  |
| 27 | 2 | 0,2,3 |  |  |  |
| 28-31 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-8: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2

| **One Codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 2 | 0,1,2,3,8 | 1 |
| 1 | 1 | 1 | 1 | 1 | 2 | 0,1,2,3,8,10 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,8,9,10 | 1 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,8,9,10,11 | 1 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0-4 | 2 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0,1,2,3,4,6 | 2 |
| 6 | 2 | 3 | 1 | 6 | 2 | 0,1,2,3,4,5,6 | 2 |
| 7 | 2 | 0,1 | 1 | 7 | 2 | 0,1,2,3,4,5,6,7 | 2 |
| 8 | 2 | 2,3 | 1 | 8 | 1 | 0,1,4,5,8 | 2 |
| 9 | 2 | 0-2 | 1 | 9 | 1 | 0,1,4,5,8,12 | 2 |
| 10 | 2 | 0-3 | 1 | 10 | 1 | 0,1,4,5,8,9,12 | 2 |
| 11 | 2 | 0,2 | 1 | 11 | 1 | 0,1,4,5,8,9,12,13 | 2 |
| 12 | 1 | 8 | 1 | 12 | 2 | 0,1,4,5,8 | 2 |
| 13 | 1 | 9 | 1 | 13 | 2 | 0,1,4,5,8,12 | 2 |
| 14 | 1 | 8,9 | 1 | 14 | 2 | 0,1,4,5,8,9,12 | 2 |
| 15 | 2 | 8 | 1 | 15 | 2 | 0,1,4,5,8,9,12,13 | 2 |
| 16 | 2 | 9 | 1 | 16~127 | Reserved | Reserved | Reserved |
| 17 | 2 | 10 | 1 |  |  |  |  |
| 18 | 2 | 11 | 1 |  |  |  |  |
| 19 | 2 | 8,9 | 1 |  |  |  |  |
| 20 | 2 | 10,11 | 1 |  |  |  |  |
| 21 | 1 | 0,1,8 | 1 |  |  |  |  |
| 22 | 1 | 0,1,8,9 | 1 |  |  |  |  |
| 23 | 2 | 0,1,8 | 1 |  |  |  |  |
| 24 | 2 | 0,1,8,9 | 1 |  |  |  |  |
| 25 | 2 | 2,3,10 | 1 |  |  |  |  |
| 26 | 2 | 2,3,10,11 | 1 |  |  |  |  |
| 27 | 2 | 0 | 2 |  |  |  |  |
| 28 | 2 | 1 | 2 |  |  |  |  |
| 29 | 2 | 2 | 2 |  |  |  |  |
| 30 | 2 | 3 | 2 |  |  |  |  |
| 31 | 2 | 4 | 2 |  |  |  |  |
| 32 | 2 | 5 | 2 |  |  |  |  |
| 33 | 2 | 6 | 2 |  |  |  |  |
| 34 | 2 | 7 | 2 |  |  |  |  |
| 35 | 2 | 0,1 | 2 |  |  |  |  |
| 36 | 2 | 2,3 | 2 |  |  |  |  |
| 37 | 2 | 4,5 | 2 |  |  |  |  |
| 38 | 2 | 6,7 | 2 |  |  |  |  |
| 39 | 2 | 0,4 | 2 |  |  |  |  |
| 40 | 2 | 2,6 | 2 |  |  |  |  |
| 41 | 2 | 0,1,4 | 2 |  |  |  |  |
| 42 | 2 | 2,3,6 | 2 |  |  |  |  |
| 43 | 2 | 0,1,4,5 | 2 |  |  |  |  |
| 44 | 2 | 2,3,6,7 | 2 |  |  |  |  |
| 45 | 2 | 0,2,4,6 | 2 |  |  |  |  |
| 46 | 2 | 8 | 2 |  |  |  |  |
| 47 | 2 | 9 | 2 |  |  |  |  |
| 48 | 2 | 10 | 2 |  |  |  |  |
| 49 | 2 | 11 | 2 |  |  |  |  |
| 50 | 2 | 12 | 2 |  |  |  |  |
| 51 | 2 | 13 | 2 |  |  |  |  |
| 52 | 2 | 14 | 2 |  |  |  |  |
| 53 | 2 | 15 | 2 |  |  |  |  |
| 54 | 2 | 8,9 | 2 |  |  |  |  |
| 55 | 2 | 10,11 | 2 |  |  |  |  |
| 56 | 2 | 12,13 | 2 |  |  |  |  |
| 57 | 2 | 14,15 | 2 |  |  |  |  |
| 58 | 2 | 0,1,8 | 2 |  |  |  |  |
| 59 | 2 | 0,1,8,9 | 2 |  |  |  |  |
| 60 | 2 | 4,5,12 | 2 |  |  |  |  |
| 61 | 2 | 4,5,12,13 | 2 |  |  |  |  |
| 62 | 2 | 2,3,10 | 2 |  |  |  |  |
| 63 | 2 | 2,3,10,11 | 2 |  |  |  |  |
| 64 | 2 | 6,7,14 | 2 |  |  |  |  |
| 65 | 2 | 6,7,14,15 | 2 |  |  |  |  |
| 66-127 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-8A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=1,  
*dmrs-TypeEnh* is configured, *maxLength*=2

| **One Codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 2 | 0,1,2,3,8 | 1 |
| 1 | 1 | 1 | 1 | 1 | 2 | 0,1,2,3,8,10 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,8,9,10 | 1 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0,1,2,3,8,9,10,11 | 1 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0-4 | 2 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0,1,2,3,4,6 | 2 |
| 6 | 2 | 3 | 1 | 6 | 2 | 0,1,2,3,4,5,6 | 2 |
| 7 | 2 | 0,1 | 1 | 7 | 2 | 0,1,2,3,4,5,6,7 | 2 |
| 8 | 2 | 2,3 | 1 | 8 | 1 | 0,1,4,5,8 | 2 |
| 9 | 2 | 0-2 | 1 | 9 | 1 | 0,1,4,5,8,12 | 2 |
| 10 | 2 | 0-3 | 1 | 10 | 1 | 0,1,4,5,8,9,12 | 2 |
| 11 | 2 | 0,2 | 1 | 11 | 1 | 0,1,4,5,8,9,12,13 | 2 |
| 12 | 1 | 8 | 1 | 12 | 2 | 0,1,4,5,8 | 2 |
| 13 | 1 | 9 | 1 | 13 | 2 | 0,1,4,5,8,12 | 2 |
| 14 | 1 | 8,9 | 1 | 14 | 2 | 0,1,4,5,8,9,12 | 2 |
| 15 | 2 | 8 | 1 | 15 | 2 | 0,1,4,5,8,9,12,13 | 2 |
| 16 | 2 | 9 | 1 | 16~127 | Reserved | Reserved | Reserved |
| 17 | 2 | 10 | 1 |  |  |  |  |
| 18 | 2 | 11 | 1 |  |  |  |  |
| 19 | 2 | 8,9 | 1 |  |  |  |  |
| 20 | 2 | 10,11 | 1 |  |  |  |  |
| 21 | 1 | 0,1,8 | 1 |  |  |  |  |
| 22 | 1 | 0,1,8,9 | 1 |  |  |  |  |
| 23 | 2 | 0,1,8 | 1 |  |  |  |  |
| 24 | 2 | 0,1,8,9 | 1 |  |  |  |  |
| 25 | 2 | 2,3,10 | 1 |  |  |  |  |
| 26 | 2 | 2,3,10,11 | 1 |  |  |  |  |
| 27 | 2 | 0 | 2 |  |  |  |  |
| 28 | 2 | 1 | 2 |  |  |  |  |
| 29 | 2 | 2 | 2 |  |  |  |  |
| 30 | 2 | 3 | 2 |  |  |  |  |
| 31 | 2 | 4 | 2 |  |  |  |  |
| 32 | 2 | 5 | 2 |  |  |  |  |
| 33 | 2 | 6 | 2 |  |  |  |  |
| 34 | 2 | 7 | 2 |  |  |  |  |
| 35 | 2 | 0,1 | 2 |  |  |  |  |
| 36 | 2 | 2,3 | 2 |  |  |  |  |
| 37 | 2 | 4,5 | 2 |  |  |  |  |
| 38 | 2 | 6,7 | 2 |  |  |  |  |
| 39 | 2 | 0,4 | 2 |  |  |  |  |
| 40 | 2 | 2,6 | 2 |  |  |  |  |
| 41 | 2 | 0,1,4 | 2 |  |  |  |  |
| 42 | 2 | 2,3,6 | 2 |  |  |  |  |
| 43 | 2 | 0,1,4,5 | 2 |  |  |  |  |
| 44 | 2 | 2,3,6,7 | 2 |  |  |  |  |
| 45 | 2 | 0,2,4,6 | 2 |  |  |  |  |
| 46 | 2 | 8 | 2 |  |  |  |  |
| 47 | 2 | 9 | 2 |  |  |  |  |
| 48 | 2 | 10 | 2 |  |  |  |  |
| 49 | 2 | 11 | 2 |  |  |  |  |
| 50 | 2 | 12 | 2 |  |  |  |  |
| 51 | 2 | 13 | 2 |  |  |  |  |
| 52 | 2 | 14 | 2 |  |  |  |  |
| 53 | 2 | 15 | 2 |  |  |  |  |
| 54 | 2 | 8,9 | 2 |  |  |  |  |
| 55 | 2 | 10,11 | 2 |  |  |  |  |
| 56 | 2 | 12,13 | 2 |  |  |  |  |
| 57 | 2 | 14,15 | 2 |  |  |  |  |
| 58 | 2 | 0,1,8 | 2 |  |  |  |  |
| 59 | 2 | 0,1,8,9 | 2 |  |  |  |  |
| 60 | 2 | 4,5,12 | 2 |  |  |  |  |
| 61 | 2 | 4,5,12,13 | 2 |  |  |  |  |
| 62 | 2 | 2,3,10 | 2 |  |  |  |  |
| 63 | 2 | 2,3,10,11 | 2 |  |  |  |  |
| 64 | 2 | 6,7,14 | 2 |  |  |  |  |
| 65 | 2 | 6,7,14,15 | 2 |  |  |  |  |
| 66 | 2 | 0,2,3 | 1 |  |  |  |  |
| 67-127 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-9: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1

| One codeword:  Codeword 0 enabled,  Codeword 1 disabled | | | Two codewords:  Codeword 0 enabled,  Codeword 1 enabled | | |
| --- | --- | --- | --- | --- | --- |
| Value | Number of DMRS CDM group(s) without data | DMRS port(s) | Value | Number of DMRS CDM group(s) without data | DMRS port(s) |
| 0 | 1 | 0 | 0 | 3 | 0-4 |
| 1 | 1 | 1 | 1 | 3 | 0-5 |
| 2 | 1 | 0,1 | 2 | 2 | 0,1,2,3,12 |
| 3 | 2 | 0 | 3 | 2 | 0,1,2,3,12,14 |
| 4 | 2 | 1 | 4 | 2 | 0-3,12-14 |
| 5 | 2 | 2 | 5 | 2 | 0-3,12-15 |
| 6 | 2 | 3 | 6 | 3 | 0,1,2,3,12 |
| 7 | 2 | 0,1 | 7 | 3 | 0,1,2,3,12,14 |
| 8 | 2 | 2,3 | 8 | 3 | 0-3,12-14 |
| 9 | 2 | 0-2 | 9 | 3 | 0-3,12-15 |
| 10 | 2 | 0-3 | 10~63 | Reserved | Reserved |
| 11 | 3 | 0 |  |  |  |
| 12 | 3 | 1 |  |  |  |
| 13 | 3 | 2 |  |  |  |
| 14 | 3 | 3 |  |  |  |
| 15 | 3 | 4 |  |  |  |
| 16 | 3 | 5 |  |  |  |
| 17 | 3 | 0,1 |  |  |  |
| 18 | 3 | 2,3 |  |  |  |
| 19 | 3 | 4,5 |  |  |  |
| 20 | 3 | 0-2 |  |  |  |
| 21 | 3 | 3-5 |  |  |  |
| 22 | 3 | 0-3 |  |  |  |
| 23 | 2 | 0,2 |  |  |  |
| 24 | 1 | 12 |  |  |  |
| 25 | 1 | 13 |  |  |  |
| 26 | 1 | 12,13 |  |  |  |
| 27 | 2 | 12 |  |  |  |
| 28 | 2 | 13 |  |  |  |
| 29 | 2 | 14 |  |  |  |
| 30 | 2 | 15 |  |  |  |
| 31 | 2 | 12,13 |  |  |  |
| 32 | 2 | 14,15 |  |  |  |
| 33 | 3 | 12 |  |  |  |
| 34 | 3 | 13 |  |  |  |
| 35 | 3 | 14 |  |  |  |
| 36 | 3 | 15 |  |  |  |
| 37 | 3 | 16 |  |  |  |
| 38 | 3 | 17 |  |  |  |
| 39 | 3 | 12,13 |  |  |  |
| 40 | 3 | 14,15 |  |  |  |
| 41 | 3 | 16,17 |  |  |  |
| 42 | 1 | 0,1,12 |  |  |  |
| 43 | 1 | 0,1,12,13 |  |  |  |
| 44 | 2 | 0,1,12 |  |  |  |
| 45 | 2 | 0,1,12,13 |  |  |  |
| 46 | 2 | 2,3,14 |  |  |  |
| 47 | 2 | 2,3,14,15 |  |  |  |
| 48 | 3 | 0,1,12 |  |  |  |
| 49 | 3 | 0,1,12,13 |  |  |  |
| 50 | 3 | 2,3,14 |  |  |  |
| 51 | 3 | 2,3,14,15 |  |  |  |
| 52 | 3 | 4,5,16 |  |  |  |
| 53 | 3 | 4,5,16,17 |  |  |  |
| 54-63 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-9A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| One codeword:  Codeword 0 enabled,  Codeword 1 disabled | | | Two codewords:  Codeword 0 enabled,  Codeword 1 enabled | | |
| Value | Number of DMRS CDM group(s) without data | DMRS port(s) | Value | Number of DMRS CDM group(s) without data | DMRS port(s) |
| 0 | 1 | 0 | 0 | 3 | 0-4 |
| 1 | 1 | 1 | 1 | 3 | 0-5 |
| 2 | 1 | 0,1 | 2 | 2 | 0,1,2,3,12 |
| 3 | 2 | 0 | 3 | 2 | 0,1,2,3,12,14 |
| 4 | 2 | 1 | 4 | 2 | 0-3,12-14 |
| 5 | 2 | 2 | 5 | 2 | 0-3,12-15 |
| 6 | 2 | 3 | 6 | 3 | 0,1,2,3,12 |
| 7 | 2 | 0,1 | 7 | 3 | 0,1,2,3,12,14 |
| 8 | 2 | 2,3 | 8 | 3 | 0-3,12-14 |
| 9 | 2 | 0-2 | 9 | 3 | 0-3,12-15 |
| 10 | 2 | 0-3 | 10~63 | Reserved | Reserved |
| 11 | 3 | 0 |  |  |  |
| 12 | 3 | 1 |  |  |  |
| 13 | 3 | 2 |  |  |  |
| 14 | 3 | 3 |  |  |  |
| 15 | 3 | 4 |  |  |  |
| 16 | 3 | 5 |  |  |  |
| 17 | 3 | 0,1 |  |  |  |
| 18 | 3 | 2,3 |  |  |  |
| 19 | 3 | 4,5 |  |  |  |
| 20 | 3 | 0-2 |  |  |  |
| 21 | 3 | 3-5 |  |  |  |
| 22 | 3 | 0-3 |  |  |  |
| 23 | 2 | 0,2 |  |  |  |
| 24 | 1 | 12 |  |  |  |
| 25 | 1 | 13 |  |  |  |
| 26 | 1 | 12,13 |  |  |  |
| 27 | 2 | 12 |  |  |  |
| 28 | 2 | 13 |  |  |  |
| 29 | 2 | 14 |  |  |  |
| 30 | 2 | 15 |  |  |  |
| 31 | 2 | 12,13 |  |  |  |
| 32 | 2 | 14,15 |  |  |  |
| 33 | 3 | 12 |  |  |  |
| 34 | 3 | 13 |  |  |  |
| 35 | 3 | 14 |  |  |  |
| 36 | 3 | 15 |  |  |  |
| 37 | 3 | 16 |  |  |  |
| 38 | 3 | 17 |  |  |  |
| 39 | 3 | 12,13 |  |  |  |
| 40 | 3 | 14,15 |  |  |  |
| 41 | 3 | 16,17 |  |  |  |
| 42 | 1 | 0,1,12 |  |  |  |
| 43 | 1 | 0,1,12,13 |  |  |  |
| 44 | 2 | 0,1,12 |  |  |  |
| 45 | 2 | 0,1,12,13 |  |  |  |
| 46 | 2 | 2,3,14 |  |  |  |
| 47 | 2 | 2,3,14,15 |  |  |  |
| 48 | 3 | 0,1,12 |  |  |  |
| 49 | 3 | 0,1,12,13 |  |  |  |
| 50 | 3 | 2,3,14 |  |  |  |
| 51 | 3 | 2,3,14,15 |  |  |  |
| 52 | 3 | 4,5,16 |  |  |  |
| 53 | 3 | 4,5,16,17 |  |  |  |
| 54 | 2 | 0,2,3 |  |  |  |
| 55-63 | Reserved | Reserved |  |  |  |

Table 7.3.1.2.2-10: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2

| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 3 | 0-4 | 1 |
| 1 | 1 | 1 | 1 | 1 | 3 | 0-5 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,12 | 1 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0-3,12,14 | 1 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0-3,12-14 | 1 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0-3,12-15 | 1 |
| 6 | 2 | 3 | 1 | 6 | 3 | 0,1,2,3,12 | 1 |
| 7 | 2 | 0,1 | 1 | 7 | 3 | 0-3,12,14 | 1 |
| 8 | 2 | 2,3 | 1 | 8 | 3 | 0-3,12-14 | 1 |
| 9 | 2 | 0-2 | 1 | 9 | 3 | 0-3,12-15 | 1 |
| 10 | 2 | 0-3 | 1 | 10 | 2 | 0,1,2,3,6 | 2 |
| 11 | 3 | 0 | 1 | 11 | 2 | 0,1,2,3,6,8 | 2 |
| 12 | 3 | 1 | 1 | 12 | 2 | 0,1,2,3,6,7,8 | 2 |
| 13 | 3 | 2 | 1 | 13 | 2 | 0,1,2,3,6,7,8,9 | 2 |
| 14 | 3 | 3 | 1 | 14 | 1 | 0,1,6,7,12 | 2 |
| 15 | 3 | 4 | 1 | 15 | 1 | 0,1,6,7,12,18 | 2 |
| 16 | 3 | 5 | 1 | 16 | 1 | 0,1,6,7,12,13,18 | 2 |
| 17 | 3 | 0,1 | 1 | 17 | 1 | 0,1,6,7,12,13,18,19 | 2 |
| 18 | 3 | 2,3 | 1 | 18 | 2 | 0,1,6,7,12 | 2 |
| 19 | 3 | 4,5 | 1 | 19 | 2 | 0,1,6,7,12,18 | 2 |
| 20 | 3 | 0-2 | 1 | 20 | 2 | 0,1,6,7,12,13,18 | 2 |
| 21 | 3 | 3-5 | 1 | 21 | 2 | 0,1,6,7,12,13,18,19 | 2 |
| 22 | 3 | 0-3 | 1 | 22 | 3 | 0,1,6,7,12 | 2 |
| 23 | 2 | 0,2 | 1 | 23 | 3 | 0,1,6,7,12,18 | 2 |
| 24 | 1 | 12 | 1 | 24 | 3 | 0,1,6,7,12,13,18 | 2 |
| 25 | 1 | 13 | 1 | 25 | 3 | 0,1,6,7,12,13,18,19 | 2 |
| 26 | 1 | 12,13 | 1 | 26~255 | Reserved | Reserved | Reserved |
| 27 | 2 | 12 | 1 |  |  |  |  |
| 28 | 2 | 13 | 1 |  |  |  |  |
| 29 | 2 | 14 | 1 |  |  |  |  |
| 30 | 2 | 15 | 1 |  |  |  |  |
| 31 | 2 | 12,13 | 1 |  |  |  |  |
| 32 | 2 | 14,15 | 1 |  |  |  |  |
| 33 | 3 | 12 | 1 |  |  |  |  |
| 34 | 3 | 13 | 1 |  |  |  |  |
| 35 | 3 | 14 | 1 |  |  |  |  |
| 36 | 3 | 15 | 1 |  |  |  |  |
| 37 | 3 | 16 | 1 |  |  |  |  |
| 38 | 3 | 17 | 1 |  |  |  |  |
| 39 | 3 | 12,13 | 1 |  |  |  |  |
| 40 | 3 | 14,15 | 1 |  |  |  |  |
| 41 | 3 | 16,17 | 1 |  |  |  |  |
| 42 | 1 | 0,1,12 | 1 |  |  |  |  |
| 43 | 1 | 0,1,12,13 | 1 |  |  |  |  |
| 44 | 2 | 0,1,12 | 1 |  |  |  |  |
| 45 | 2 | 0,1,12,13 | 1 |  |  |  |  |
| 46 | 2 | 2,3,14 | 1 |  |  |  |  |
| 47 | 2 | 2,3,14,15 | 1 |  |  |  |  |
| 48 | 3 | 0,1,12 | 1 |  |  |  |  |
| 49 | 3 | 0,1,12,13 | 1 |  |  |  |  |
| 50 | 3 | 2,3,14 | 1 |  |  |  |  |
| 51 | 3 | 2,3,14,15 | 1 |  |  |  |  |
| 52 | 3 | 4,5,16 | 1 |  |  |  |  |
| 53 | 3 | 4,5,16,17 | 1 |  |  |  |  |
| 54 | 3 | 0 | 2 |  |  |  |  |
| 55 | 3 | 1 | 2 |  |  |  |  |
| 56 | 3 | 2 | 2 |  |  |  |  |
| 57 | 3 | 3 | 2 |  |  |  |  |
| 58 | 3 | 4 | 2 |  |  |  |  |
| 59 | 3 | 5 | 2 |  |  |  |  |
| 60 | 3 | 6 | 2 |  |  |  |  |
| 61 | 3 | 7 | 2 |  |  |  |  |
| 62 | 3 | 8 | 2 |  |  |  |  |
| 63 | 3 | 9 | 2 |  |  |  |  |
| 64 | 3 | 10 | 2 |  |  |  |  |
| 65 | 3 | 11 | 2 |  |  |  |  |
| 66 | 3 | 0,1 | 2 |  |  |  |  |
| 67 | 3 | 2,3 | 2 |  |  |  |  |
| 68 | 3 | 4,5 | 2 |  |  |  |  |
| 69 | 3 | 6,7 | 2 |  |  |  |  |
| 70 | 3 | 8,9 | 2 |  |  |  |  |
| 71 | 3 | 10,11 | 2 |  |  |  |  |
| 72 | 3 | 0,1,6 | 2 |  |  |  |  |
| 73 | 3 | 2,3,8 | 2 |  |  |  |  |
| 74 | 3 | 4,5,10 | 2 |  |  |  |  |
| 75 | 3 | 0,1,6,7 | 2 |  |  |  |  |
| 76 | 3 | 2,3,8,9 | 2 |  |  |  |  |
| 77 | 3 | 4,5,10,11 | 2 |  |  |  |  |
| 78 | 1 | 0 | 2 |  |  |  |  |
| 79 | 1 | 1 | 2 |  |  |  |  |
| 80 | 1 | 6 | 2 |  |  |  |  |
| 81 | 1 | 7 | 2 |  |  |  |  |
| 82 | 1 | 0,1 | 2 |  |  |  |  |
| 83 | 1 | 6,7 | 2 |  |  |  |  |
| 84 | 2 | 0,1 | 2 |  |  |  |  |
| 85 | 2 | 2,3 | 2 |  |  |  |  |
| 86 | 2 | 6,7 | 2 |  |  |  |  |
| 87 | 2 | 8,9 | 2 |  |  |  |  |
| 88 | 3 | 12 | 2 |  |  |  |  |
| 89 | 3 | 13 | 2 |  |  |  |  |
| 90 | 3 | 14 | 2 |  |  |  |  |
| 91 | 3 | 15 | 2 |  |  |  |  |
| 92 | 3 | 16 | 2 |  |  |  |  |
| 93 | 3 | 17 | 2 |  |  |  |  |
| 94 | 3 | 18 | 2 |  |  |  |  |
| 95 | 3 | 19 | 2 |  |  |  |  |
| 96 | 3 | 20 | 2 |  |  |  |  |
| 97 | 3 | 21 | 2 |  |  |  |  |
| 98 | 3 | 22 | 2 |  |  |  |  |
| 99 | 3 | 23 | 2 |  |  |  |  |
| 100 | 3 | 12,13 | 2 |  |  |  |  |
| 101 | 3 | 14,15 | 2 |  |  |  |  |
| 102 | 3 | 16,17 | 2 |  |  |  |  |
| 103 | 3 | 18,19 | 2 |  |  |  |  |
| 104 | 3 | 20,21 | 2 |  |  |  |  |
| 105 | 3 | 22,23 | 2 |  |  |  |  |
| 106 | 1 | 12 | 2 |  |  |  |  |
| 107 | 1 | 13 | 2 |  |  |  |  |
| 108 | 1 | 18 | 2 |  |  |  |  |
| 109 | 1 | 19 | 2 |  |  |  |  |
| 110 | 1 | 12,13 | 2 |  |  |  |  |
| 111 | 1 | 18,19 | 2 |  |  |  |  |
| 112 | 2 | 12,13 | 2 |  |  |  |  |
| 113 | 2 | 14,15 | 2 |  |  |  |  |
| 114 | 2 | 18,19 | 2 |  |  |  |  |
| 115 | 2 | 20,21 | 2 |  |  |  |  |
| 116 | 2 | 0,1,12 | 2 |  |  |  |  |
| 117 | 2 | 0,1,12,13 | 2 |  |  |  |  |
| 118 | 2 | 6,7,18 | 2 |  |  |  |  |
| 119 | 2 | 6,7,18,19 | 2 |  |  |  |  |
| 120 | 2 | 2,3,14 | 2 |  |  |  |  |
| 121 | 2 | 2,3,14,15 | 2 |  |  |  |  |
| 122 | 2 | 8,9,20 | 2 |  |  |  |  |
| 123 | 2 | 8,9,20,21 | 2 |  |  |  |  |
| 124 | 3 | 0,1,12 | 2 |  |  |  |  |
| 125 | 3 | 0,1,12,13 | 2 |  |  |  |  |
| 126 | 3 | 6,7,18 | 2 |  |  |  |  |
| 127 | 3 | 6,7,18,19 | 2 |  |  |  |  |
| 128 | 3 | 2,3,14 | 2 |  |  |  |  |
| 129 | 3 | 2,3,14,15 | 2 |  |  |  |  |
| 130 | 3 | 8,9,20 | 2 |  |  |  |  |
| 131 | 3 | 8,9,20,21 | 2 |  |  |  |  |
| 132 | 3 | 4,5,16 | 2 |  |  |  |  |
| 133 | 3 | 4,5,16,17 | 2 |  |  |  |  |
| 134 | 3 | 10,11,22 | 2 |  |  |  |  |
| 135 | 3 | 10,11,22,23 | 2 |  |  |  |  |
| 136-255 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-10A: Antenna port(s) (1000 + DMRS port), *dmrs-Type*=2,  
*dmrs-TypeEnh* is configured, *maxLength*=2

| **One codeword:**  **Codeword 0 enabled,**  **Codeword 1 disabled** | | | | **Two Codewords:**  **Codeword 0 enabled,**  **Codeword 1 enabled** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** | **Value** | **Number of DMRS CDM group(s) without data** | **DMRS port(s)** | **Number of front-load symbols** |
| 0 | 1 | 0 | 1 | 0 | 3 | 0-4 | 1 |
| 1 | 1 | 1 | 1 | 1 | 3 | 0-5 | 1 |
| 2 | 1 | 0,1 | 1 | 2 | 2 | 0,1,2,3,12 | 1 |
| 3 | 2 | 0 | 1 | 3 | 2 | 0-3,12,14 | 1 |
| 4 | 2 | 1 | 1 | 4 | 2 | 0-3,12-14 | 1 |
| 5 | 2 | 2 | 1 | 5 | 2 | 0-3,12-15 | 1 |
| 6 | 2 | 3 | 1 | 6 | 3 | 0,1,2,3,12 | 1 |
| 7 | 2 | 0,1 | 1 | 7 | 3 | 0-3,12,14 | 1 |
| 8 | 2 | 2,3 | 1 | 8 | 3 | 0-3,12-14 | 1 |
| 9 | 2 | 0-2 | 1 | 9 | 3 | 0-3,12-15 | 1 |
| 10 | 2 | 0-3 | 1 | 10 | 2 | 0,1,2,3,6 | 2 |
| 11 | 3 | 0 | 1 | 11 | 2 | 0,1,2,3,6,8 | 2 |
| 12 | 3 | 1 | 1 | 12 | 2 | 0,1,2,3,6,7,8 | 2 |
| 13 | 3 | 2 | 1 | 13 | 2 | 0,1,2,3,6,7,8,9 | 2 |
| 14 | 3 | 3 | 1 | 14 | 1 | 0,1,6,7,12 | 2 |
| 15 | 3 | 4 | 1 | 15 | 1 | 0,1,6,7,12,18 | 2 |
| 16 | 3 | 5 | 1 | 16 | 1 | 0,1,6,7,12,13,18 | 2 |
| 17 | 3 | 0,1 | 1 | 17 | 1 | 0,1,6,7,12,13,18,19 | 2 |
| 18 | 3 | 2,3 | 1 | 18 | 2 | 0,1,6,7,12 | 2 |
| 19 | 3 | 4,5 | 1 | 19 | 2 | 0,1,6,7,12,18 | 2 |
| 20 | 3 | 0-2 | 1 | 20 | 2 | 0,1,6,7,12,13,18 | 2 |
| 21 | 3 | 3-5 | 1 | 21 | 2 | 0,1,6,7,12,13,18,19 | 2 |
| 22 | 3 | 0-3 | 1 | 22 | 3 | 0,1,6,7,12 | 2 |
| 23 | 2 | 0,2 | 1 | 23 | 3 | 0,1,6,7,12,18 | 2 |
| 24 | 1 | 12 | 1 | 24 | 3 | 0,1,6,7,12,13,18 | 2 |
| 25 | 1 | 13 | 1 | 25 | 3 | 0,1,6,7,12,13,18,19 | 2 |
| 26 | 1 | 12,13 | 1 | 26~255 | Reserved | Reserved | Reserved |
| 27 | 2 | 12 | 1 |  |  |  |  |
| 28 | 2 | 13 | 1 |  |  |  |  |
| 29 | 2 | 14 | 1 |  |  |  |  |
| 30 | 2 | 15 | 1 |  |  |  |  |
| 31 | 2 | 12,13 | 1 |  |  |  |  |
| 32 | 2 | 14,15 | 1 |  |  |  |  |
| 33 | 3 | 12 | 1 |  |  |  |  |
| 34 | 3 | 13 | 1 |  |  |  |  |
| 35 | 3 | 14 | 1 |  |  |  |  |
| 36 | 3 | 15 | 1 |  |  |  |  |
| 37 | 3 | 16 | 1 |  |  |  |  |
| 38 | 3 | 17 | 1 |  |  |  |  |
| 39 | 3 | 12,13 | 1 |  |  |  |  |
| 40 | 3 | 14,15 | 1 |  |  |  |  |
| 41 | 3 | 16,17 | 1 |  |  |  |  |
| 42 | 1 | 0,1,12 | 1 |  |  |  |  |
| 43 | 1 | 0,1,12,13 | 1 |  |  |  |  |
| 44 | 2 | 0,1,12 | 1 |  |  |  |  |
| 45 | 2 | 0,1,12,13 | 1 |  |  |  |  |
| 46 | 2 | 2,3,14 | 1 |  |  |  |  |
| 47 | 2 | 2,3,14,15 | 1 |  |  |  |  |
| 48 | 3 | 0,1,12 | 1 |  |  |  |  |
| 49 | 3 | 0,1,12,13 | 1 |  |  |  |  |
| 50 | 3 | 2,3,14 | 1 |  |  |  |  |
| 51 | 3 | 2,3,14,15 | 1 |  |  |  |  |
| 52 | 3 | 4,5,16 | 1 |  |  |  |  |
| 53 | 3 | 4,5,16,17 | 1 |  |  |  |  |
| 54 | 3 | 0 | 2 |  |  |  |  |
| 55 | 3 | 1 | 2 |  |  |  |  |
| 56 | 3 | 2 | 2 |  |  |  |  |
| 57 | 3 | 3 | 2 |  |  |  |  |
| 58 | 3 | 4 | 2 |  |  |  |  |
| 59 | 3 | 5 | 2 |  |  |  |  |
| 60 | 3 | 6 | 2 |  |  |  |  |
| 61 | 3 | 7 | 2 |  |  |  |  |
| 62 | 3 | 8 | 2 |  |  |  |  |
| 63 | 3 | 9 | 2 |  |  |  |  |
| 64 | 3 | 10 | 2 |  |  |  |  |
| 65 | 3 | 11 | 2 |  |  |  |  |
| 66 | 3 | 0,1 | 2 |  |  |  |  |
| 67 | 3 | 2,3 | 2 |  |  |  |  |
| 68 | 3 | 4,5 | 2 |  |  |  |  |
| 69 | 3 | 6,7 | 2 |  |  |  |  |
| 70 | 3 | 8,9 | 2 |  |  |  |  |
| 71 | 3 | 10,11 | 2 |  |  |  |  |
| 72 | 3 | 0,1,6 | 2 |  |  |  |  |
| 73 | 3 | 2,3,8 | 2 |  |  |  |  |
| 74 | 3 | 4,5,10 | 2 |  |  |  |  |
| 75 | 3 | 0,1,6,7 | 2 |  |  |  |  |
| 76 | 3 | 2,3,8,9 | 2 |  |  |  |  |
| 77 | 3 | 4,5,10,11 | 2 |  |  |  |  |
| 78 | 1 | 0 | 2 |  |  |  |  |
| 79 | 1 | 1 | 2 |  |  |  |  |
| 80 | 1 | 6 | 2 |  |  |  |  |
| 81 | 1 | 7 | 2 |  |  |  |  |
| 82 | 1 | 0,1 | 2 |  |  |  |  |
| 83 | 1 | 6,7 | 2 |  |  |  |  |
| 84 | 2 | 0,1 | 2 |  |  |  |  |
| 85 | 2 | 2,3 | 2 |  |  |  |  |
| 86 | 2 | 6,7 | 2 |  |  |  |  |
| 87 | 2 | 8,9 | 2 |  |  |  |  |
| 88 | 3 | 12 | 2 |  |  |  |  |
| 89 | 3 | 13 | 2 |  |  |  |  |
| 90 | 3 | 14 | 2 |  |  |  |  |
| 91 | 3 | 15 | 2 |  |  |  |  |
| 92 | 3 | 16 | 2 |  |  |  |  |
| 93 | 3 | 17 | 2 |  |  |  |  |
| 94 | 3 | 18 | 2 |  |  |  |  |
| 95 | 3 | 19 | 2 |  |  |  |  |
| 96 | 3 | 20 | 2 |  |  |  |  |
| 97 | 3 | 21 | 2 |  |  |  |  |
| 98 | 3 | 22 | 2 |  |  |  |  |
| 99 | 3 | 23 | 2 |  |  |  |  |
| 100 | 3 | 12,13 | 2 |  |  |  |  |
| 101 | 3 | 14,15 | 2 |  |  |  |  |
| 102 | 3 | 16,17 | 2 |  |  |  |  |
| 103 | 3 | 18,19 | 2 |  |  |  |  |
| 104 | 3 | 20,21 | 2 |  |  |  |  |
| 105 | 3 | 22,23 | 2 |  |  |  |  |
| 106 | 1 | 12 | 2 |  |  |  |  |
| 107 | 1 | 13 | 2 |  |  |  |  |
| 108 | 1 | 18 | 2 |  |  |  |  |
| 109 | 1 | 19 | 2 |  |  |  |  |
| 110 | 1 | 12,13 | 2 |  |  |  |  |
| 111 | 1 | 18,19 | 2 |  |  |  |  |
| 112 | 2 | 12,13 | 2 |  |  |  |  |
| 113 | 2 | 14,15 | 2 |  |  |  |  |
| 114 | 2 | 18,19 | 2 |  |  |  |  |
| 115 | 2 | 20,21 | 2 |  |  |  |  |
| 116 | 2 | 0,1,12 | 2 |  |  |  |  |
| 117 | 2 | 0,1,12,13 | 2 |  |  |  |  |
| 118 | 2 | 6,7,18 | 2 |  |  |  |  |
| 119 | 2 | 6,7,18,19 | 2 |  |  |  |  |
| 120 | 2 | 2,3,14 | 2 |  |  |  |  |
| 121 | 2 | 2,3,14,15 | 2 |  |  |  |  |
| 122 | 2 | 8,9,20 | 2 |  |  |  |  |
| 123 | 2 | 8,9,20,21 | 2 |  |  |  |  |
| 124 | 3 | 0,1,12 | 2 |  |  |  |  |
| 125 | 3 | 0,1,12,13 | 2 |  |  |  |  |
| 126 | 3 | 6,7,18 | 2 |  |  |  |  |
| 127 | 3 | 6,7,18,19 | 2 |  |  |  |  |
| 128 | 3 | 2,3,14 | 2 |  |  |  |  |
| 129 | 3 | 2,3,14,15 | 2 |  |  |  |  |
| 130 | 3 | 8,9,20 | 2 |  |  |  |  |
| 131 | 3 | 8,9,20,21 | 2 |  |  |  |  |
| 132 | 3 | 4,5,16 | 2 |  |  |  |  |
| 133 | 3 | 4,5,16,17 | 2 |  |  |  |  |
| 134 | 3 | 10,11,22 | 2 |  |  |  |  |
| 135 | 3 | 10,11,22,23 | 2 |  |  |  |  |
| 136 | 2 | 0,2,3 | 1 |  |  |  |  |
| 137-255 | Reserved | Reserved | Reserved |  |  |  |  |

Table 7.3.1.2.2-11: TCI selection

|  |  |
| --- | --- |
| **Bit field mapped to index** | **TCI selection** |
| 0 | The first indicated joint/DL TCI state is applied to the scheduled PDSCH |
| 1 | The second indicated joint/DL TCI state is applied to the scheduled PDSCH |
| 2 | Both indicated joint/DL TCI states are applied to the scheduled PDSCH |
| 3 | Reserved |

Table 7.3.1.2.2-12: Co-scheduled UE information

|  |  |
| --- | --- |
| **Bit field mapped to index** | **Co-scheduled UE information** |
| 0 | In all the PRBs allocated to the UE, there is no co-scheduled UE or there is co-scheduled UE but with a different root DMRS sequence |
| 1 | In all the PRBs allocated to the UE, all the co-scheduled UE(s), if any, which have the same root DMRS sequence as the UE, are scheduled with modulation scheme QPSK |
| 2 | In all the PRBs allocated to the UE, all the co-scheduled UE(s), if any, which have the same root DMRS sequence as the UE, are scheduled with modulation scheme 16QAM |
| 3 | In all the PRBs allocated to the UE, all the co-scheduled UE(s), if any, which have the same root DMRS sequence as the UE, are scheduled with modulation scheme 64QAM |
| 4 | In all the PRBs allocated to the UE, all the co-scheduled UE(s), if any, which have the same root DMRS sequence as the UE, are scheduled with modulation scheme 256QAM |
| 5 | In all the PRBs allocated to the UE, all the co-scheduled UE(s), if any, which have the same root DMRS sequence as the UE, are scheduled with modulation scheme 1024QAM |
| 6 | In each individual PRB allocated to the UE, all the co-scheduled UE(s), which have the same root DMRS sequence as the UE, are scheduled with the same modulation scheme, except the cases corresponding to index 0~5 |
| 7 | All cases not covered above |
| Note: Root DMRS sequence is as defined in clause 7.4.1.1.1 of [4, TS 38.211] | |

##### 7.3.1.2.3 Format 1\_2

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

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

- Identifier for DCI formats - 1 bits

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

- Carrier indicator - 0, 1, 2 or 3 bits determined by higher layer parameter *carrierIndicatorSizeDCI-1-2*, as defined in Clause 10.1 of [5, TS38.213]. This field is reserved when this format is carried by PDCCH on the primary cell and the UE is configured for scheduling on the primary cell from an SCell, with the same number of bits as that in this format carried by PDCCH on the SCell for scheduling on the primary cell.

- Bandwidth part indicator - 0, 1 or 2 bits as determined by the number of DL BWPs configured by higher layers, excluding the initial DL 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 5.1.2.2.1 of [6, TS 38.214];

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

- If *resourceAllocationDCI-1-2-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 5.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214]

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if *resourceAllocationDCI-1-2-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, or 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationListDCI-1-2* if the higher layer parameter is configured, or *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationList* if the higher layer parameter *pdsch-TimeDomainAllocationList* is configured when the higher layer parameter *pdsch-TimeDomainAllocationListDCI-1-2* is not configured; otherwise *I* is the number of entries in the default table.

- VRB-to-PRB mapping - 0 or 1 bit:

- 0 bit if the higher layer parameter *vrb-ToPRB-InterleaverDCI-1-2* is not configured;

- 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].

- PRB bundling size indicator - 0 bit if the higher layer parameter *prb-BundlingTypeDCI-1-2* is not configured or is set to 'static', or 1 bit if the higher layer parameter *prb-BundlingTypeDCI-1-2* is set to 'dynamic' according to Clause 5.1.2.3 of [6, TS 38.214].

- Rate matching indicator - 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1DCI-1-2* and *rateMatchPatternGroup2DCI-1-2*, where the MSB is used to indicate *rateMatchPatternGroup1DCI-1-2* and the LSB is used to indicate *rateMatchPatternGroup2DCI-1-2* when there are two groups.

- ZP CSI-RS trigger - 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured by higher layer parameter *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2*.

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator - 1 bit

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

- 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 - number of bits determined by the following:

- 0, 1, 2, 3, 4 or 5 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-1-2-v1700* if configured;

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

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

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

- 1, 2 or 4 bits determined by higher layer parameter *downlinkAssignmentIndexDCI-1-2* otherwise,

- 4 bits if more than one serving cell are configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI

- 4 bits if only one serving cell is configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, and the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode = joint*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI.

- 1 or 2 bits if only one serving cell is configured in the DL and the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, when the UE is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided or the UE is not configured with *ackNackFeedbackMode = joint,* where the 1 bit or 2 bits are the counter DAI.

If the UE is configured with a PUCCH-SCell, the number of serving cells is determined within a PUCCH group.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* if present for the secondary PUCCH group.

If higher layer parameter *priorityIndicatorDCI-1-2* is configured, if the bit width of the Downlink assignment index in DCI format 1\_2 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index 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 Downlink assignment index until the bit width of the Downlink assignment index in DCI format 1\_2 for the two HARQ-ACK codebooks are the same.

- 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*

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

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

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

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

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

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

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedbackDCI-1-2* or *pdsch-HARQ-ACK-EnhType3DCI-1-2* is configured;

- 0 bit otherwise.

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

- 0 bit if *pdsch-HARQ-ACK-EnhType3DCI-Field-1-2* is not configured;

- bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-EnhType3ToAddModList.*

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* for the secondary PUCCH group.

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

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

- 0 bit otherwise.

- Antenna port(s) - 0, 4, 5, 6, 7 or 8 bits

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

- Otherwise 4, 5, 6, 7 or 8 bits as defined by Tables 7.3.1.2.2-1/2/3/4/7/8/9/10 and Tables 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A, 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 7.3.1.2.2-1/2/3/4/7/8/9/10 or Tables 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A. When a UE not configured with *dl-OrJointTCI-StateList* receives an activation command that maps at least one codepoint of DCI field '*Transmission Configuration Indication*' to two TCI states, or when a UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI states, the UE shall use Table 7.3.1.2.2-1A/2A/3A/4A/7A/8A/9A/10A; otherwise, it shall use Tables 7.3.1.2.2-1/2/3/4/7/8/9/10.

- 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 7.3.1.2.2-1/2/3/4/7/8/9/10.

- 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.

- TCI selection - 0 bit if higher layer parameter *tciSelection-PresentInDCI* is not configured; otherwise 2 bits according to Table 7.3.1.2.2-11.

- 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 for any aperiodic SRS resource set in the scheduled cell, or if higher layer parameter *AvailableSlotOffset* is configured for at least one aperiodic SRS resource set in the scheduled cell and the maximum number of entries of *availableSlotOffsetList* configured for all aperiodic SRS resource set(s) is 1;

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

- 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].

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

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

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

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

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

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

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

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

- 0 bit, otherwise

- ChannelAccess-CPext - 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-2* or in Table 7.3.1.1.1-4A if *channelAccessMode-r16* = "*semiStatic*" is provided, for operation in a cell with shared spectrum channel access in frequency range 1, or the number of entries in the high layer parameter *ul-AccessConfigListDCI-1-1* foroperation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 are configured by the higher layer parameter *ul-AccessConfigListDCI-1-2* in frequency range 1*.* One or more entries from Table 7.3.1.1.2-6A are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1* in frequency range 2-2*.*

- PUCCH Cell indicator - 0 or 1 bit.

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

- 0 bit otherwise.

If DCI formats 1\_2 are monitored in multiple search spaces associated with multiple CORESETs in a BWP for scheduling the same serving cell, zeros shall be appended until the payload size of the DCI formats 1\_2 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_2 monitored in the multiple search spaces.

For a UE configured with scheduling on the primary cell from an SCell, if prior to padding the number of information bits in DCI format 1\_2 carried by PDCCH on the primary cell is not equal to the number of information bits in DCI format 1\_2 carried by PDCCH on the SCell for scheduling on the primary cell, zeros shall be appended to the DCI format 1\_2 with smaller size until the payload size is the same.

- If application of step 4B in clause 7.3.1.0 results in additional zero padding for DCI format 1\_2 for scheduling on the primary cell, corresponding zeros shall be appended to both DCI format 1\_2 monitored on the primary cell and DCI format 1\_2 monitored on the SCell for scheduling on the primary cell.

- If the SCell is deactivated and *firstActiveDownlinkBWP-Id* is not set to dormant BWP, the UE determines the number of information bits in DCI format 1\_2 carried by PDCCH on the primary cell based on a DL BWP provided by *firstActiveDownlinkBWP-Id* for the SCell. If the active DL BWP of the SCell is a dormant DL BWP, or if the SCell is deactivated and *firstActiveDownlinkBWP-Id* is set to dormant BWP, the UE determines the number of information bits in DCI format 1\_2 carried by PDCCH on the primary cell based on a DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided; otherwise, based on a DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.

Table 7.3.1.2.3-1: Redundancy version

|  |  |
| --- | --- |
| Value of the Redundancy version field | Value of  to be applied |
| 0 | 0 |
| 1 | 3 |

##### 7.3.1.2.4 Format 1\_3

DCI format 1\_3 is used for the scheduling of one PDSCH in one cell, or multiple PDSCHs in multiple cells with one PDSCH per cell.

The following information is transmitted by means of the DCI format 1\_3 with CRC scrambled by C-RNTI or MCS-C-RNTI:

- Identifier for DCI formats - 1 bits

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

- Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *MC-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *MC-DCI-SetofCellsToAddModList*.

- Scheduled cells indicator - number of bits determined by the following:

- 0 bit if the higher layer parameter *scheduledCellComboListDCI-1-3* for the scheduled cell set is not configured;

- otherwise bits indicating the scheduled cells in the scheduled cell set according to Table 7.3.1.2.4-1, where is the number of entries in the higher layer parameter *scheduledCellComboListDCI-1-3.* If only one entry is configured in the higher layer parameter *scheduledCellComboListDCI-1-3*, the scheduled cells are the cells configured by higher layer parameter *scheduledCellComboListDCI-1-3*.

- Bandwidth part indicator - 0, 1 or 2 bits determined as , where

- if , is the maximum number of DL BWPs configured by higher layers, excluding the initial DL bandwidth part, across all the cells configured by higher layer parameter *scheduledCellListDCI-1-3* in the scheduled cell set, 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;

The field is only applicable to a scheduled cell with the number of configured DL BWPs larger than 1, including the initial DL bandwidth part, and is applied to the applicable scheduled cells in the scheduled cell set independently. If a UE does not support active BWP change via DCI, the UE ignores this bit field. If this field indicates a code point that does not correspond to a configured BWP of a scheduled cell, the UE ignores this bit field for the scheduled cell, and operates on the active BWP of the scheduled cell.

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

- block number 1, block number 2,…, block number

If *scheduledCellComboListDCI-1-3* for the scheduled cell set is configured with more than one entry,  is the number of scheduled cells indicated by Scheduled cells indicator field; if *scheduledCellComboListDCI-1-3* for the scheduled cell set is configured with only one entry, is the number of cells configured by higher layer parameter *scheduledCellComboListDCI-1-3*; otherwise, is the number of cells in the scheduled cell set configured by higher layer parameter *scheduledCellListDCI-1-3*. Each block corresponds to the frequency domain resource assignment for a cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the frequency domain resource assignment for the cell with the smallest serving cell index. Each block is defined by the following fields:

- bits if only resource allocation type 0 is configured, where is defined in Clause 5.1.2.2.1 of [6, TS 38.214]

- bits if only resource allocation type 1 is configured, or bits if *resourceAllocationDCI-1-3* is configured as '*dynamicSwitch'*, where is the size of the active DL bandwidth part, is defined as in clause 4.4.4.4 of [4, TS 38.211] and is given by higher layer parameter *resourceAllocationType1GranularityDCI-1-3.* If the higher layer parameter *resourceAllocationType1GranularityDCI-1-3* is not configured, is equal to 1.

- If *resourceAllocationDCI-1-3* 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 5.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214].

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and if *resourceAllocationDCI-1-3* 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 *scheduledCellComboListDCI-1-3* for the scheduled cell set is not configured, each block is also used to indicate whether the corresponding cell is scheduled or not as follows:

- if all bits of a block 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, the cell corresponding to the block is not scheduled;

- otherwise, the cell corresponding to the block is scheduled.

- Time domain resource assignment - bits, where is the number of entries in the higher layer parameter *tdra-FieldIndexListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *tdra-FieldIndexListDCI-1-3* according to Table 7.3.1.2.4-2. Each entry in the higher layer parameter *tdra-FieldIndexListDCI-1-3* contains the ‘Time domain resource assignment’ index for each BWP of each cell in the scheduled cell set, where the ‘Time domain resource assignment’ indexes for all the cells are placed according to an ascending order of a serving cell index, and the 'Time domain resource assignment' indexes for all the BWPs of a cell are placed according to an ascending order of the higher layer parameter *BWP-Id*.

- VRB-to-PRB mapping - 0 or 1 bit

- 0 bit if the higher layer parameter *vrb-ToPRB-Interleaver* is not configured for any cell configured by higher layer parameter *scheduledCellListDCI-1-3* in the scheduled cell set;

- 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].

The field is only applicable to a scheduled cell configured with *vrb-ToPRB-Interleaver*, and is applied to the applicable scheduled cells independently.

- PRB bundling size indicator - 0 or 1 bit

- 0 bit if the higher layer parameter *prb-BundlingType* is not configured or is set to 'staticBundling' for any cell configured by higher layer parameter *scheduledCellListDCI-1-3* in the scheduled cell set;

- 1 bit according to Clause 5.1.2.3 of [6, TS 38.214] otherwise.

The field is only applicable to a scheduled cell configured with *prb-BundlingType* set to 'dynamicBundling', and is applied to the applicable scheduled cells independently.

- Rate matching indicator -bits, where is the number of entries in the higher layer parameter *rateMatchListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *rateMatchListDCI-1-3* according to Table 7.3.1.2.4-3. Each entry in the higher layer parameter *rateMatchListDCI-1-3* contains the ‘Rate matching indicator’ index for each cell configured with *rateMatchPatternGroup1* or *rateMatchPatternGroup2* on at least one DL BWP in the scheduled cell set, where the ‘Rate matching indicator’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘Rate matching indicator’ index is defined by the following:

- 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2*, where the MSB is used to indicate *rateMatchPatternGroup1* and the LSB is used to indicate *rateMatchPatternGroup2* when there are two groups.

- ZP CSI-RS trigger -bits, where is the number of entries in the higher layer parameter *zp-CSI-RSListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *zp-CSI-RSListDCI-1-3* according to Table 7.3.1.2.4-4. Each entry in the higher layer parameter *zp-CSI-RSListDCI-1-3* contains the ‘ZP CSI-RS trigger’ index for each cell configured with *aperiodicZP-CSI-RS-ResourceSetsToAddModList* on at least one DL BWP in the scheduled cell set, where the ‘ZP CSI-RS trigger’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘ZP CSI-RS trigger’ index is defined by the following:

- 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured by higher layer parameter *aperiodicZP-CSI-RS-ResourceSetsToAddModList*.

For transport block 1:

- Modulation and coding scheme - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the modulation and coding scheme for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the modulation and coding scheme for the cell with the smallest serving cell index. Each block is 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214].

- New data indicator - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the new data indicator for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the new data indicator for the cell with the smallest serving cell index. Each block is 1 bit.

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

- block number 1, block number 2,…, block number

Each block corresponds to the redundancy version for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the redundancy version for the cell with the smallest serving cell index. Each block is 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-1-3* configured for the cell corresponding to the block,

- 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.

For transport block 2:

- Modulation and coding scheme - number of bits determined by the following:

- block number 1, block number 2,…, block number

If *scheduledCellComboListDCI-1-3* for the scheduled cell set is configured, is the number of scheduled cells indicated by Scheduled cells indicator field and configured with *maxNrofCodeWordsScheduledByDCI = 2*; otherwise, is the number of cells configured by higher layer parameter *scheduledCellListDCI-1-3* in the scheduled cell set and configured with *maxNrofCodeWordsScheduledByDCI = 2*. Each block corresponds to the modulation and coding scheme for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the modulation and coding scheme for the cell with the smallest serving cell index. Each block is 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214].

- New data indicator - number of bits determined by the following:

- block number 1, block number 2,…, block number

Each block corresponds to the new data indicator for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the new data indicator for the cell with the smallest serving cell index. Each block is 1 bit.

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

- block number 1, block number 2,…, block number

Each block corresponds to the redundancy version for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the redundancy version for the cell with the smallest serving cell index. Each block is 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-1-3* configured for the cell corresponding to the block,

- 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.

If "Bandwidth part indicator" field indicates a bandwidth part other than the active bandwidth part and the value of *maxNrofCodeWordsScheduledByDCI* for the indicated bandwidth part equals 2 and the value of *maxNrofCodeWordsScheduledByDCI* for the active bandwidth part equals 1, the UE assumes zeros are padded when interpreting the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields of transport block 2 according to Clause 12 of [5, TS38.213], and the UE ignores the "Modulation and coding scheme", "New data indicator", and "Redundancy version" fields of transport block 2 for the indicated bandwidth part.

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

- block number 1, block number 2,…, block number

Each block corresponds to the HARQ process number for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the HARQ process number for the cell with the smallest serving cell index. Each block is 0, 1, 2, 3, 4 or 5 bits determined by higher layer parameter *harq-ProcessNumberSizeDCI-1-3* configured for the cell corresponding to the block.

- Downlink assignment index - number of bits as defined in the following

- 4 bits if the higher layer parameter *pdsch-HARQ-ACK-Codebook=dynamic*, where the 2 MSB bits are the counter DAI and the 2 LSB bits are the total DAI;

- 0 bits otherwise.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* if present for the secondary PUCCH group.

If higher layer parameter *priorityIndicatorDCI-1-3* is configured, if the bit width of the Downlink assignment index in DCI format 1\_3 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index in DCI format 1\_3 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 1\_3 for the two HARQ-ACK codebooks are the same.

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

- 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-1-3* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 for the other HARQ-ACK codebook on the same cell for PUCCH transmission, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 for the two HARQ-ACK codebooks are the same.

If higher layer parameter *pucch-sSCellDynDCI-1-3* is configured, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 associated with one cell for PUCCH transmission is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 associated with the other cell for PUCCH transmission, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 1\_3 associated with the two cells are the same.

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

- 1 bit if higher layer parameter pdsch-HARQ-ACK-OneShotFeedbackDCI-1-3 or pdsch-HARQ-ACK-enhType3DCI-1-3 is configured;

- 0 bit otherwise.

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

- 0 bit if pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-3 is not configured;

- bits otherwise, where is the number of entries in the higher layer parameter pdsch-HARQ-ACK-EnhType3ToAddModList.

If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryList* for the secondary PUCCH group*.*

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

- 1 bit if higher layer parameter *pdsch-HARQ-ACK-retxDCI-1-3* is configured.

- 0 bit otherwise.

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

- If *antennaPortsDCI-1-3= type1a* is configured by higher layer,

- bits applying to the scheduled cells independently, where is the number of cells configured by higher layer parameter *scheduledCellListDCI-1-3* in the scheduled cell set, is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined below.

- If *antennaPortsDCI-1-3= type2* is configured by higher layer,

- block number 1, block number 2,…, block number

Each block corresponds to the Antenna ports information for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the Antenna ports information for the cell with the smallest serving cell index. Each block is defined below.

above for the case of *antennaPortsDCI-1-3= type1A* or each block above for the case of *antennaPortsDCI-1-3= type2* is defined by the following:

- 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.

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 - number of bits determined by the following:

- 0 bit if higher layer parameter *tci-PresentInDCI* is not enabled;

- otherwise bits, where is the number of entries in the higher layer parameter *tci-ListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *tci-ListDCI-1-3* according to Table 7.3.1.2.4-5. Each entry in the higher layer parameter *tci-ListDCI-1-3* contains the ‘Transmission configuration indication’ index for each cell in the scheduled cell set, where the ‘Transmission configuration indication’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘Transmission configuration indication’ index is 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\_3,

- 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 -bits, where is the number of entries in the higher layer parameter *srs-RequestListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *srs-RequestListDCI-1-3* according to Table 7.3.1.2.4-6. Each entry in the higher layer parameter *srs-RequestListDCI-1-3* contains the ‘SRS request’ index for each cell in the scheduled cell set, where the ‘SRS request’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘SRS request’ index is defined by the following:

- 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 -bits, where is the number of entries in the higher layer parameter *srs-OffsetListDCI-1-3*. This field is used to indicate an entry in the higher layer parameter *srs-OffsetListDCI-1-3* according to Table 7.3.1.2.4-7. Each entry in the higher layer parameter *srs-OffsetListDCI-1-3* contains the ‘SRS offset indicator’ index for each cell in the scheduled cell set, where the ‘SRS offset indicator’ indexes for all the cells are placed according to an ascending order of a serving cell index. Each ‘SRS offset indicator’ index is defined by the following:

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

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

- DMRS sequence initialization - 1 bit. This field is applied to all the scheduled cells indicated by Scheduled cells indicator field or Frequency domain resource assignment field independently.

- Priority indicator - 0 bit if higher layer parameter *priorityIndicatorDCI-1-3* 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 in frequency range 1, or for operation in frequency range 2-2 if *ChannelAccessMode2-r17* is provided; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 or Table 7.3.1.2.2-6A 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 *minimumSchedulingOffsetK0DCI-1-3* is not configured;

- 1 bit otherwise. The 1 bit indication is used to determine the minimum applicable K0 for the active DL BWP and the minimum applicable K2 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 for each scheduled cell shall be the same as the minimum applicable K0.

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

If the “One-shot HARQ-ACK request” field is not present or set to '0', and if the “HARQ-ACK retransmission indicator” field is not present or set to ‘0’, and if all bits of the corresponding block(s) of the frequency domain resource assignment field 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 for one or more cells in the scheduled cell set, this field is reserved and the following fields, corresponding to the cell with smallest serving cell index among the one or more cell(s), 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) if *antennaPortsDCI1-3= type2* is configured by higher layer.

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

- 0 bit if higher layer parameter *pdcchMonAdaptDCI-1-3* is not enabled;

- otherwise,

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

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

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

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

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

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

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

- PUCCH Cell indicator - 0 or 1 bit.

- 1 bit if higher layer parameter *pucch-sSCellDynDCI-1-3* is configured.

- 0 bit otherwise.

If *scheduledCellComboListDCI-1-3* for the cell set is configured, zeros shall be appended to DCI format 1\_3 if needed until the payload size equals the size of DCI format 1\_3 that is determined by the configuration of the corresponding active bandwidth part(s) of the scheduled cells in the entry which results in the largest size among the entries in the higher layer parameter *scheduledCellComboListDCI-1-3*.

If an SCell within the scheduled cell set is deactivated and the *firstActiveDownlinkBWP-Id* corresponding to the SCell is not set to dormant BWP, the UE determines the bitwidth of the fields in DCI format 1\_3 based on a DL BWP provided by *firstActiveDownlinkBWP-Id* for the SCell. If the active DL BWP of an SCell within the scheduled cell set is a dormant DL BWP, or if an SCell within the scheduled cell set is deactivated and the *firstActiveDownlinkBWP-Id* corresponding to the SCell is set to dormant BWP, the UE determines the bitwidth of the fields in DCI format 1\_3 based on a DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided; otherwise, based on a DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.

Table 7.3.1.2.4-1: Scheduled cells indicator in DCI format 1\_3

|  |  |
| --- | --- |
| **Bit field mapped to index** | **Scheduled cells** |
| 0 | The cells configured by the 1st entry in *scheduledCellComboListDCI-1-3* |
| 1 | The cells configured by the 2nd entry in *scheduledCellComboListDCI-1-3* |
| 2 | The cells configured by the 3rd entry in *scheduledCellComboListDCI-1-3*, if any |
| 3 | The cells configured by the 4th entry in *scheduledCellComboListDCI-1-3*, if any |
| 4 | The cells configured by the 5th entry in *scheduledCellComboListDCI-1-3*, if any |
| 5 | The cells configured by the 6th entry in *scheduledCellComboListDCI-1-3*, if any |
| 6 | The cells configured by the 7th entry in *scheduledCellComboListDCI-1-3*, if any |
| 7 | The cells configured by the 8th entry in *scheduledCellComboListDCI-1-3*, if any |
| 8 | The cells configured by the 9th entry in *scheduledCellComboListDCI-1-3*, if any |
| 9 | The cells configured by the 10th entry in *scheduledCellComboListDCI-1-3*, if any |
| 10 | The cells configured by the 11th entry in *scheduledCellComboListDCI-1-3*, if any |
| 11 | The cells configured by the 12th entry in *scheduledCellComboListDCI-1-3* if any |
| 12 | The cells configured by the 13th entry in *scheduledCellComboListDCI-1-3*, if any |
| 13 | The cells configured by the 14th entry in *scheduledCellComboListDCI-1-3*, if any |
| 14 | The cells configured by the 15th entry in *scheduledCellComboListDCI-1-3*, if any |
| 15 | The cells configured by the 16th entry in *scheduledCellComboListDCI-1-3*, if any |

Table 7.3.1.2.4-2: Time domain resource assignment in DCI format 1\_3

|  |  |
| --- | --- |
| **Bit field mapped to index** | **Indicated time domain resource allocation** |
| 0 | The 1st entry in *tdra-FieldIndexListDCI-1-3* |
| 1 | The 2nd entry in *tdra-FieldIndexListDCI-1-3* |
| 2 | The 3rd entry in *tdra-FieldIndexListDCI-1-3*, if any |
| … | … |
|  | The entry in *tdra-FieldIndexListDCI-1-3*, if any |
| … | … |

Table 7.3.1.2.4-3: Rate matching indicator

|  |  |
| --- | --- |
| Bit field mapped to index | Indicated rate matching pattern |
| 0 | The 1st entry in *rateMatchListDCI-1-3* |
| 1 | The 2nd entry in *rateMatchListDCI-1-3* |
| 2 | The 3rd entry in *rateMatchListDCI-1-3*, if any |
| … | … |
| 15 | The 16th entry in *rateMatchListDCI-1-3*, if any |

Table 7.3.1.2.4-4: ZP CSI-RS trigger

|  |  |
| --- | --- |
| Bit field mapped to index | Triggered aperiodic ZP CSI-RS |
| 0 | The 1st entry in *zp-CSI-RSListDCI-1-3* |
| 1 | The 2nd entry in *zp-CSI-RSListDCI-1-3* |
| 2 | The 3rd entry in *zp-CSI-RSListDCI-1-3*, if any |
| … | … |
| 7 | The 8th entry in *zp-CSI-RSListDCI-1-3*, if any |

Table 7.3.1.2.4-5: Transmission configuration indication

|  |  |
| --- | --- |
| Bit field mapped to index | Indicated transmission configuration indication |
| 0 | The 1st entry in *tci-ListDCI-1-3* |
| 1 | The 2nd entry in *tci-ListDCI-1-3* |
| 2 | The 3rd entry in *tci-ListDCI-1-3*, if any |
| … | … |
| 15 | The 16th entry in *tci-ListDCI-1-3*, if any |

Table 7.3.1.1.4-6: SRS request in DCI format 1\_3

|  |  |
| --- | --- |
| Bit field mapped to index | Triggered aperiodic SRS resource set(s) |
| 0 | The 1st entry in *srs-RequestListDCI-1-3* |
| 1 | The 2nd entry in *srs-RequestListDCI-1-3* |
| 2 | The 3rd entry in *srs-RequestListDCI-1-3*, if any |
| … | … |
| 15 | The 16th entry in *srs-RequestListDCI-1-3*, if any |

Table 7.3.1.1.4-7: SRS offset indicator in DCI format 1\_3

|  |  |
| --- | --- |
| Bit field mapped to index | Available slot offset |
| 0 | The 1st entry in *srs-OffsetListDCI-1-3* |
| 1 | The 2nd entry in *srs-OffsetListDCI-1-3* |
| 2 | The 3rd entry in *srs-OffsetListDCI-1-3*, if any |
| … | … |
| 7 | The 8th entry in *srs-OffsetListDCI-1-3*, if any |

#### 7.3.1.3 DCI formats for other purposes

##### 7.3.1.3.1 Format 2\_0

DCI format 2\_0 is used for notifying the slot format, COT duration, available RB set, and search space set group switching.

The following information is transmitted by means of the DCI format 2\_0 with CRC scrambled by SFI-RNTI:

- If the higher layer parameter *slotFormatCombToAddModList* is configured,

- Slot format indicator 1, Slot format indicator 2, …, Slot format indicator *N*,

- If the higher layer parameter *availableRB-SetsToAddModList* is configured,

- Available RB set Indicator 1, Available RB set Indicator 2, …, Available RB set Indicator *N1*,

- If the higher layer parameter *co-DurationsPerCellToAddModList* is configured

- COT duration indicator 1, COT duration indicator 2, …, COT duration indicator *N2.*

- If the higher layer parameter *switchTriggerToAddModList* is configured

- Search space set group switching flag 1, Search space set group switching flag 2, …, Search space set group switching flag *M.*

The size of DCI format 2\_0 is configurable by higher layers up to 128 bits, according to Clause 11.1.1 of [5, TS 38.213].

##### 7.3.1.3.2 Format 2\_1

DCI format 2\_1 is used for notifying the PRB(s) and OFDM symbol(s) where UE may assume no transmission is intended for the UE.

The following information is transmitted by means of the DCI format 2\_1 with CRC scrambled by INT-RNTI:

- Pre-emption indication 1, Pre-emption indication 2, …, Pre-emption indication *N*.

The size of DCI format 2\_1 is configurable by higher layers up to 126 bits, according to Clause 11.2 of [5, TS 38.213]. Each pre-emption indication is 14 bits.

##### 7.3.1.3.3 Format 2\_2

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

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

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

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

- Closed loop indicator - 0 or 1 bit.

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

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

- TPC command -2 bits

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

##### 7.3.1.3.4 Format 2\_3

DCI format 2\_3 is used for the transmission of a group of TPC commands for SRS transmissions by one or more UEs. Along with a TPC command, a SRS request may also be transmitted.

The following information is transmitted by means of the DCI format 2\_3 with CRC scrambled by TPC-SRS-RNTI:

- block number 1, block number 2, …, block number 

where the starting position of a block is determined by the parameter *startingBitOfFormat2-3* or *startingBitOfFormat2-3SUL-v1530* provided by higher layers for the UE configured with the block.

If the UE is configured with higher layer parameter *srs-TPC-PDCCH-Group* = *typeA* for an UL without PUCCH and PUSCH or an UL on which the SRS power control is not tied with PUSCH power control, one or two blocks are configured for the UE by higher layers where one block applies to non-SUL carriers and another block applies to SUL carriers, with the following fields defined for each block:

- SRS request - 0 or 2 bits. The presence of this field is according to the definition in Clause 11.4 of [5, TS38.213]. If present, this field is interpreted as defined by Table 7.3.1.1.2-24.

- TPC command number 1, TPC command number 2, ..., TPC command number *N*, where each TPC command applies to a respective UL carrier provided by higher layer parameter *cc-IndexInOneCC-Set*

If the UE is configured with higher layer parameter *srs-TPC-PDCCH-Group* = *typeB* for an UL without PUCCH and PUSCH or an UL on which the SRS power control is not tied with PUSCH power control, one block or more blocks is configured for the UE by higher layers where each block applies to an UL carrier, with the following fields defined for each block:

- SRS request - 0 or 2 bits. The presence of this field is according to the definition in Clause 11.4 of [5, TS38.213]. If present, this field is interpreted as defined by Table 7.3.1.1.2-24.

- TPC command -2 bits

The number of information bits in format 2\_3 shall be equal to or less than the payload size of format 1\_0 monitored in common search space in the same serving cell. If the number of information bits in format 2\_3 is less than the payload size of format 1\_0 monitored in common search space in the same serving cell, zeros shall be appended to format 2\_3 until the payload size equals that of format 1\_0 monitored in common search space in the same serving cell.

##### 7.3.1.3.5 Format 2\_4

DCI format 2\_4 is used for notifying the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE according to Clause 11.2A of [5, TS 38.213].

The following information is transmitted by means of the DCI format 2\_4 with CRC scrambled by CI-RNTI:

- Cancellation indication 1, Cancellation indication 2, …, Cancellation indication indication *N*.

The size of DCI format 2\_4 is configurable by higher layers parameter *dci-PayloadSizeForCI* up to 126 bits, according to Clause 11.2A of [5, TS 38.213]. The number of bits for each cancellation indication is configurable by higher layer parameter *ci-PayloadSize*. For a UE, there is at most one cancellation indication for an UL carrier.

##### 7.3.1.3.6 Format 2\_5

DCI format 2\_5 is used for notifying the availability of soft resources as defined in Clause 9.3.1 of [10, TS 38.473]

The following information is transmitted by means of the DCI format 2\_5 with CRC scrambled by AI-RNTI:

- Availability indicator 1, Availability indicator 2, …, Availability indicator *N*.

The size of DCI format 2\_5 is configurable by higher layers up to 128 bits, according to Clause 14 of [5, TS 38.213].

##### 7.3.1.3.7 Format 2\_6

DCI format 2\_6 is used for notifying the power saving information outside DRX Active Time for one or more UEs.

The following information is transmitted by means of the DCI format 2\_6 with CRC scrambled by PS-RNTI:

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

where the starting position of a block is determined by the parameter *ps-PositionDCI-2-6* provided by higher layers for the UE configured with the block.

If the UE is configured with higher layer parameter *ps-RNTI* and *dci-Format2-6*, one block is configured for the UE by higher layers, with the following fields defined for the block:

- Wake-up indication - 1 bit

- SCell dormancy indication - 0 bit if higher layer parameter *dormancyGroupOutsideActiveTime* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to the number of different *DormancyGroupID(s)* provided by higher layer parameter *dormancyGroupOutsideActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupOutsideActiveTime,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group in ascending order of *DormancyGroupID*.

The size of DCI format 2\_6 is indicated by the higher layer parameter *sizeDCI-2-6*, according to Clause 10.3 of [5, TS 38.213].

##### 7.3.1.3.8 Format 2\_7

DCI format 2\_7 is used for notifying the paging early indication and TRS availability indication for one or more UEs.

The following information is transmitted by means of the DCI format 2\_7 with CRC scrambled by PEI-RNTI:

- Paging indication field - bit(s), where

- is the number of paging occasions configured by higher layer parameter *po-NumPerPEI* as defined in Clause 10.4A in [5, TS 38.213];

- is the number of sub-groups of a paging occasion configured by higher layer parameter *subgroupsNumPerPO*.

- Each bit in the field indicates one UE subgroup of a paging occasion.

- TRS availability indication - 1, 2, 3, 4, 5, or 6 bits, where the number of bits is equal to one plus the highest value of all the *indBitID*(s) provided by the *trs-ResourceSetConfig* if configured; 0 bits otherwise.

The size of DCI format 2\_7 is indicated by the higher layer parameter *payloadSizeDCI-2-7*, according to Clause 10.4A of [5, TS 38.213]. The number of information bits in format 2\_7 shall be equal to or less than the payload size of format 2\_7. If the number of information bits in format 2\_7 is less than the size of format 2\_7, the remaining bits are reserved.

##### 7.3.1.3.9 Format 2\_8

DCI format 2\_8 is used for notifying the aperiodic beam indication and associated time resources

The following information is transmitted by means of the DCI format 2\_8 with CRC scrambled by NCR-RNTI:

- Beam index 1, Beam index 2, …, Beam index N

The bitwidth of each beam index field is determined by the higher layer parameter *aperiodicBeamFieldWidth*.

- Time resource indication 1, Time resource indication 2, …, Time resource indication N

The bitwidth of each time resource indication field is determined by max, where is the number of time domain resources configured by *aperiodicFwdConfig*. The bit field indexes of a time resource indication field are mapped to the time domain resources configured by *aperiodicFwdConfig* according to an ascending order of a resource identity configured by *aperiodicFwdTimeRsrcId*, with the bit field index 0 mapped to the time resource with the smallest resource identity.

The N beam indexes are sequentially associated with the N time resource indications with one to one mapping. N is configured by the higher layer parameter *numberOfFields*. The size of DCI format 2\_8 is up to 128 bits.

##### 7.3.1.3.10 Format 2\_9

DCI format 2\_9 is used for activating or de-activating the cell DTX and/or DRX configuration of one or multiple serving cells for one or more UEs, and/or for providing NES-mode indication of the primary cell for one or more UEs.

The following information is transmitted by means of the DCI format 2\_9 with CRC scrambled by cellDTRX-RNTI:

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

where the starting position of a block associated with a serving cell is determined by the parameter *positionInDCI-cellDTRX* provided by higher layers for the UE.

If the UE is configuredto monitor DCI 2\_9 with CRC scrambled by cellDTRX-RNTI, one or more blocks are configured for the UE by higher layers, with the following fields defined for each block:

- Cell DTX/DRX indication - number of bits determined by the following:

- If higher layer parameter *cellDTXDRX-L1activation* is configured

- 2 bits as defined in Clause 11.5 of [5, TS38.213] if *cellDTXDRXconfigType* is configured to *dtxdrx* for the associated serving cell of the block, with the MSB corresponding to cell DTX configuration and the LSB corresponding to cell DRX configuration;

- 1 bit as defined in Clause 11.5 of [5, TS38.213]if *cellDTXDRXconfigType* is configured to either *dtx* or *drx* for the associated serving cell of the block;

- 0 bit otherwise.

- NES-mode indication – 1 bit indicating NES-specific CHO execution condition as defined in Clause 11.5 of [5, TS38.213], if the higher layer parameter *nesEvent* is configured and the associated serving cell of the block is primary cell; 0 bit otherwise.

The size of DCI format 2\_9 is indicated by the higher layer parameter *sizeDCI-2-9*.

#### 7.3.1.4 DCI formats for scheduling of sidelink

##### 7.3.1.4.1 Format 3\_0

DCI format 3\_0 is used for scheduling of NR PSCCH and NR PSSCH in one cell, or scheduling of NR PSCCH, NR PSSCH and NR SL PRS for a shared SL PRS resource pool in one cell.

The following information is transmitted by means of the DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI:

- Resource pool index - bits, where *I* is the total number of resource pools for transmission configured by the higher layer parameter *sl-TxPoolScheduling*, if configured, and *sl-DiscTxPoolScheduling*, if configured.

- Time gap - 3 bits determined by higher layer parameter *sl-DCI-ToSL-Trans,* as defined in clause 8.1.2.1 of [6, TS 38.214]

- HARQ process number - 4 bits.

- New data indicator - 1 bit.

- Lowest index of the subchannel allocation to the initial transmission - bits as defined in Clause 8.1.2.2 of [6, TS 38.214].

- Lowest index of the RB set allocation to the initial transmission - bits as defined in Clause 8.1.2.2 of [6, TS 38.214] if the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'; 0 bit otherwise.

- SCI format 1-A fields according to clause 8.3.1.1:

- Frequency resource assignment.

- Time resource assignment.

- PSFCH-to-HARQ feedback timing indicator - bits, where is the number of entries in the higher layer parameter *sl-PSFCH-ToPUCCH,* as defined in clause 16.5 of [5, TS 38.213]

- PUCCH resource indicator - 3 bitsas defined in clause 16.5 of [5, TS 38.213].

- Configuration index - 0 bit if the UE is not configured to monitor DCI format 3\_0 with CRC scrambled by SL-CS-RNTI; otherwise 3 bitsas defined in clause 8.1.2 of [6, TS 38.214]. If the UE is configured to monitor DCI format 3\_0 with CRC scrambled by SL-CS-RNTI, this field is reserved for DCI format 3\_0 with CRC scrambled by SL-RNTI.

- Counter sidelink assignment index - 2 bits

- 2 bits as defined in clause 16.5.2 of [5, TS 38.213] if the UE is configured with *pdsch-HARQ-ACK-Codebook = dynamic*

- 2 bits as defined in clause 16.5.1 of [5, TS 38.213] if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*

- Padding bits, if required

If the total number of transmit resource pools provided in *sl-TxPoolScheduling*, if configured, and *sl-DiscTxPoolScheduling*, if configured, is larger than one, zeros shall be appended to the DCI format 3\_0 until the payload size is equal to the size of a DCI format 3\_0 given by a configuration of the transmit resource pool resulting in the largest number of information bits for DCI format 3\_0.

If the UE is configured to monitor DCI format 3\_1 and/or DCI format 3\_2 and the number of information bits in DCI format 3\_0 is less than the larger payload size of DCI format 3\_1 if configured and DCI format 3\_2 if configured, zeros shall be appended to DCI format 3\_0 until the payload size equals the larger payload size of DCI format 3\_1 if configured and DCI format 3\_2 if configured.

##### 7.3.1.4.2 Format 3\_1

DCI format 3\_1 is used for scheduling of LTE PSCCH and LTE PSSCH in one cell.

The following information is transmitted by means of the DCI format 3\_1 with CRC scrambled by SL Semi-Persistent Scheduling V-RNTI:

- Timing offset - 3 bits determined by higher layer parameter *sl-TimeOffsetEUTRA-List,* as defined in clause 16.6 of [5, TS 38.213]

- Carrier indicator -3 bits as defined in 5.3.3.1.9A of [11, TS 36.212].

- Lowest index of the subchannel allocation to the initial transmission -  bits as defined in 5.3.3.1.9A of [11, TS 36.212].

- Frequency resource location of initial transmission and retransmission, as defined in 5.3.3.1.9A of [11, TS 36.212]

- Time gap between initial transmission and retransmission, as defined in 5.3.3.1.9A of [11, TS 36.212]

- SL index - 2 bits as defined in 5.3.3.1.9A of [11, TS 36.212]

- SL SPS configuration index - 3 bits as defined in clause 5.3.3.1.9A of [11, TS 36.212].

- Activation/release indication - 1 bit as defined in clause 5.3.3.1.9A of [11, TS 36.212].

If the UE is configured to monitor DCI format 3\_0 and/or DCI format 3\_2 and the number of information bits in DCI format 3\_1 is less than the larger payload size of DCI format 3\_0 if configured and DCI format 3\_2 if configured, zeros shall be appended to DCI format 3\_1 until the payload size equals the larger payload size of DCI format 3\_0 if configured and DCI format 3\_2 if configured.

##### 7.3.1.4.3 Format 3\_2

DCI format 3\_2 is used for scheduling of NR SL PRS for a dedicated SL PRS resource pool in one cell.

The following information is transmitted by means of the DCI format 3\_2 with CRC scrambled by SL-PRS-RNTI or SL-PRS-CS-RNTI:

- Resource pool index - bits, where *I* is the total number of dedicated SL PRS resource pools for transmission configured by the higher layer parameter *sl-PRS-TxPoolScheduling*, if configured.

- Time gap - 3 bits determined by higher layer parameter *sl-DCI-ToSL-Trans,* as defined in clause 8.2.4.1.1 of [6, TS 38.214]

- First SL PRS indicator - bits indicating the SL PRS resource ID for the first SL PRS transmission, where the value is the total number of SL PRS resources within a slot in a dedicated SL PRS resource pool and provided by the higher layer parameter *sl-PrsResources-Dedicated-SL-PRS-RP*.

- SCI format 1-B fields according to clause 8.3.1.2:

- Time resource assignment

- Resource ID indication

- Configuration index – 0 bit if the UE is not configured to monitor DCI format 3\_2 with CRC scrambled by SL-PRS-CS-RNTI; otherwise 3 bitsas defined in clause 8.2.4.1 of [6, TS 38.214]. If the UE is configured to monitor DCI format 3\_2 with CRC scrambled by SL-PRS-CS-RNTI, this field is reserved for DCI format 3\_2 with CRC scrambled by SL-PRS-RNTI.

- Activation/release indication – 0 bit if the UE is not configured to monitor DCI format 3\_2 with CRC scrambled with SL-PRS-CS-RNTI; otherwise 1 bit, where value 0 indicates release and value 1 indicates activation. If the UE is configured to monitor DCI format 3\_2 with CRC scrambled with SL-PRS-CS-RNTI, this field is reserved for DCI format 3\_2 with CRC scrambled by SL-PRS-RNTI.

- Padding bits, if required.

If the total number of transmit resource pools provided in *sl-PRS-TxPoolScheduling*, if configured, is larger than one, zeros shall be appended to the DCI format 3\_2 until the payload size is equal to the size of a DCI format 3\_2 given by a configuration of the transmit resource pool resulting in the largest number of information bits for DCI format 3\_2.

If the UE is configured to monitor DCI format 3\_0 and/or DCI format 3\_1 and the number of information bits in DCI format 3\_2 is less than the larger payload size of DCI format 3\_0 if configured and DCI format 3\_1 if configured, zeros shall be appended to DCI format 3\_2 until the payload size equals the larger payload size of DCI format 3\_0 if configured and DCI format 3\_1 if configured.

#### 7.3.1.5 DCI formats for scheduling of MBS

##### 7.3.1.5.1 Format 4\_0

DCI format 4\_0 is used for the scheduling of PDSCH for broadcast or for multicast in RRC\_INACTIVE state in DL cell.

The following information is transmitted by means of the DCI format 4\_0 with CRC scrambled by MCCH-RNTI or G-RNTI for broadcast configured by *MBS-SessionInfo,* or by multicast-MCCH-RNTI for multicast configured by *MBS-SessionInfoMulticast*:

- Frequency domain resource assignment - bits where equals to

- the size of CORESET 0 if CORESET 0 is configured for the cell; and

- the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214]

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- MCCH change notification - 2 bits as defined in Clause 5.9.1.3 and Clause 5.10.1.3 of [9, TS38.331] if the CRC of the DCI format 4\_0 is scrambled by MCCH-RNTI and multicast-MCCH-RNTI respectively. Otherwise, this bit field is reserved.

- Reserved bits - 14bits

##### 7.3.1.5.2 Format 4\_1

DCI format 4\_1 is used for the scheduling of PDSCH for multicast in DL cell.

The following information is transmitted by means of the DCI format 4\_1 with CRC scrambled by G-RNTI for multicast or G-CS-RNTI configured by *MBS-RNTI-SpecificConfig*, or by G-RNTI for multicast configured by *MBS-SessionInfoListMulticast*:

- Frequency domain resource assignment - bits where equals to

- the size of CORESET 0 if CORESET 0 is configured for the cell; and

- the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.

- Time domain resource assignment - 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping - 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3 of [6, TS38.214]

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits

- Downlink assignment index - 2 bits as defined in Clause 9.1.3 of [5, TS 38.213], as counter DAI

- PUCCH resource indicator - 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- PDSCH-to-HARQ\_feedback timing indicator - 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- Reserved bits - 3 bits

##### 7.3.1.5.3 Format 4\_2

DCI format 4\_2 is used for the scheduling of PDSCH for multicast in DL cell.

The following information is transmitted by means of the DCI format 4\_2 with CRC scrambled by G-RNTI for multicast or G-CS-RNTI configured by *MBS-RNTI-SpecificConfig*:

- Frequency domain resource assignment - number of bits determined by the following, where is the size of the common frequency resource as defined in Clause 18 of [5, TS38.213].

- bits if only resource allocation type 0 is configured, where is defined in Clause 5.1.2.2.1 of [6, TS38.214],

- bits if only resource allocation type 1 is configured, or

- bits if *resourceAllocation* in *pdsch-ConfigMulticast* is configured as '*dynamicSwitch'*.

- If *resourceAllocation* in *pdsch-ConfigMulticast* 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 5.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214]

- Time domain resource assignment - 0, 1, 2, 3, or 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationList* if the higher layer parameter is configured; otherwise *I* is the number of entries in the default table.

- VRB-to-PRB mapping - 0 or 1 bit:

- 0 bit if only resource allocation type 0 is configured or if *vrb-ToPRB-Interleaver* in *pdsch-ConfigMulticast* is not configured;

- 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].

- PRB bundling size indicator - 0 bit if the higher layer parameter *prb-BundlingType* is not configured in *pdsch-ConfigMulticast* or is set to 'staticBundling', or 1 bit if the higher layer parameter *prb-BundlingType* in *pdsch-ConfigMulticast* is set to 'dynamicBundling' according to Clause 5.1.2.3 of [6, TS 38.214].

- Rate matching indicator - 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2* in *pdsch-ConfigMulticast*, where the MSB is used to indicate *rateMatchPatternGroup1* and the LSB is used to indicate *rateMatchPatternGroup2* when there are two groups.

- ZP CSI-RS trigger - 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured in *pdsch-ConfigMulticast*.

For transport block 1:

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

For transport block 2 (only present if *maxNrofCodeWordsScheduledByDCI* configured in *pdsch-ConfigMulticast* equals 2):

- Modulation and coding scheme - 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number - 4 bits

- Downlink assignment index - number of bits as defined in the following

- 2 bits if the higher layer parameter *pdsch-HARQ-ACK-Codebook =dynamic* is configured for multicast, where the 2 bits are the counter DAI;

- 0 bits otherwise.

If higher layer parameter *priorityIndicatorDCI-4-2* is configured in *pdsch-ConfigMulticast*, if the bit width of the Downlink assignment index in DCI format 4\_2 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index in DCI format 4\_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 4\_2 for the two HARQ-ACK codebooks are the same.

- 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* in *pucch-ConfigMulticast1* if configured or *pucch-ConfigMulticast2* if configured; otherwise, *I* is the number of entries in the higher layer parameter *dl-DataToUL-ACK* in *PUCCH-Config.*

If higher layer parameter *priorityIndicatorDCI-4-2* is configured in *pdsch-ConfigMulticast*, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 4\_2 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 4\_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 4\_2 for the two HARQ-ACK codebooks are the same.

- Antenna port(s) - 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* 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* in *pdcch-ConfigMulticast* is not enabled; otherwise 3 bits as defined in Clause 5.1.5 of [6, TS38.214].

- DMRS sequence initialization - 1 bit.

- Priority indicator - 0 bit if higher layer parameter *priorityIndicatorDCI-4-2* is not configured in *pdsch-ConfigMulticast*; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].

- Enabling/disabling HARQ-ACK feedback indication -1 bit if higher layer parameter *harq-FeedbackEnablerMulticast* indicates *dci-enabler*, where value 1 indicates enabling HARQ-ACK feedback and value 0 indicates disabling HARQ-ACK feedback; 0 bit, otherwise.

The size of DCI format 4\_2 is configurable by higher layer parameter *sizeDCI-4-2* from 20 bits and up to 140 bits.

### 7.3.2 CRC attachment

Error detection is provided on DCI transmissions through a Cyclic Redundancy Check (CRC).

The entire payload is used to calculate the CRC parity bits. Denote the bits of the payload by, and the parity bits by, where  is the payload size and  is the number of parity bits. Let  be a bit sequence such that  for  and  for . The parity bits are computed with input bit sequence  and attached according to Clause 5.1 by setting  to 24 bits and using the generator polynomial . The output bit  is

 for 

 for ,

where .

After attachment, the CRC parity bits are scrambled with the corresponding RNTI  , where  corresponds to the MSB of the RNTI, to form the sequence of bits . The relation between *ck* and *bk* is:

 for *k* = 0, 1, 2, …, 

 for *k* = , ,,..., .

### 7.3.3 Channel coding

Information bits are delivered to the channel coding block. They are denoted by  , where  is the number of bits, and they are encoded via Polar coding according to Clause 5.3.1, by setting , , , and .

After encoding the bits are denoted by , where  is the number of coded bits.

### 7.3.4 Rate matching

The input bit sequence to rate matching is .

Rate matching is performed according to Clause 5.4.1 by setting .

The output bit sequence after rate matching is denoted as .

# 8 Sidelink transport channels and control information

## 8.1 Sidelink broadcast channel

The processing for SL-BCH transport channel follows the BCH according to clause 7.1, with the following changes:

- In Clause 7.1, 'maximum of one transport block every 80ms' is replaced with 'maximum of one transport block'.

- Clause 7.1.1 for PBCH payload generation is not performed.

- Clause 7.1.2 for scrambling is not performed.

- In clause 7.1.5, the rate matching output sequence length E = 1386 when higher layer parameter *cyclicPrefix* is configured, otherwise, E = 1782.

### 8.1.1 Void

## 8.2 Sidelink shared channel

The processing for SL-SCH transport channel follows the UL-SCH according to clause 6.2, with the following changes:

- Rate matching of SL-SCH follows the rate matching according to clause 6.2.5 by setting

- Clause 6.2.7 is replaced by clause 8.2.1

### 8.2.1 Data and control multiplexing

Denote the coded bits for SL-SCH as.

Denote the coded bits for the 2nd-stage SCI, as .

Denote the multiplexed data and control coded bit sequence as , where *G* is the total number of coded bits for transmission.

Assuming that is the number of layers onto which the SL-SCH transport block is mapped, the multiplexed data and control coded bit sequence is obtained as follows:

Denote is modulation order of the 2nd-stage SCI.

if ,

for to

if

end if

if

end if

end for

end if

if ,

let

set

for to

for to

for to

if

else

// placeholder bit

end if

end for

end for

end for

for to

end for

end if

## 8.3 Sidelink control information on PSCCH

SCI carried on PSCCH is a 1st-stage SCI, which transports sidelink scheduling information.

### 8.3.1 1st-stage SCI formats

The fields defined in each of the 1st-stage SCI formats below are mapped to the information bits to as follows:

Each field is mapped in the order in which it appears in the description, with the first field mapped to the lowest order information bit and each successive field mapped to higher order information bits. 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 .

#### 8.3.1.1 SCI format 1-A

SCI format 1-A is used for the scheduling of PSSCH and 2nd-stage-SCI on PSSCH

The following information is transmitted by means of the SCI format 1-A:

- Priority - 3 bits as specified in clause 5.4.3.3 of [12, TS 23.287] and clause 5.22.1.3.1 of [8, TS 38.321]. Value '000' of Priority field corresponds to priority value '1', value '001' of Priority field corresponds to priority value '2', and so on.

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

- If higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is not configured or configured to ‘contigousRB’

- bits when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 2; otherwise bits when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 3, as defined in clause 8.1.5 of [6, TS 38.214].

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to ‘interlaceRB’

- X + Y bits provide the frequency domain resource allocation according to Clause x.x of [6, TS 38.214], where the X MSBs provide the RB set allocation and the Y LSBs provide the sub-channel allocation,

- the value of X is determined by when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 2, or determined by when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 3, where is the number of RB sets in a resource pool

- the value of Y is determined by when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 2, or determined by when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 3, as defined in clause 8.1.5 of [6, TS 38.214].

- Time resource assignment - 5 bits when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 2; otherwise 9 bits when the value of the higher layer parameter *sl-MaxNumPerReserve* is configured to 3, as defined in clause 8.1.5 of [6, TS 38.214].

- Resource reservation period - bits as defined in clause 16.4 of [5, TS 38.213], where is the number of entries in the higher layer parameter *sl-ResourceReservePeriodList*, if higher layer parameter *sl-MultiReserveResource* is configured; 0 bit otherwise.

- DMRS pattern - bits as defined in clause 8.4.1.1.2 of [4, TS 38.211], where is the number of DMRS patterns configured by higher layer parameter *sl-PSSCH-DMRS-TimePatternList*.

- 2nd-stage SCI format - 2 bits as defined in Table 8.3.1.1-1.

- Beta\_offset indicator - 2 bits as provided by higher layer parameter *sl-BetaOffsets2ndSCI* and Table 8.3.1.1-2.

- Number of DMRS port - 1 bit as defined in Table 8.3.1.1-3.

- Modulation and coding scheme - 5 bits as defined in clause 8.1.3 of [6, TS 38.214].

- Additional MCS table indicator - as defined in clause 8.1.3.1 of [6, TS 38.214]: 1 bit if one MCS table is configured by higher layer parameter *sl-Additional-MCS-Table*; 2 bits if two MCS tables are configured by higher layer parameter *sl-Additional-MCS-Table*; 0 bit otherwise.

- PSFCH overhead indication - 1 bit as defined in clause 8.1.3.2 of [6, TS 38.214] if higher layer parameter *sl-PSFCH-Period* = 2 or 4; 0 bit otherwise.

- Reserved - a number of bits as determined by the following:

- bits as configured by higher layer parameter *sl-NumReservedBits,* with value set to zero, if higher layer parameter *sl-IndicationUE-B* is not configured, or if higher layer parameter *sl-IndicationUE-B* is configured to 'disabled', and if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is not configured;

- bits if higher layer parameter *sl-IndicationUE-B* is configured to 'enabled', and if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured, with value set to zero.

- bits otherwise, with value set to zero.

- COT sharing flag – 0 or 1 bit

- 1 bit as defined in [14, TS 37.213] if the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured;

- 0 bit otherwise.- Conflict information receiver flag - 0 or 1 bit

- 1 bit if higher layer parameter *sl-IndicationUE-B* is configured to 'enabled', where the bit value of 0 indicates that the UE cannot be a UE to receive conflict information and the bit value of 1 indicates that the UE can be a UE to receive conflict information as defined in Clause 16.3.0 of [5, TS 38.213];

- 0 bit otherwise.

Table 8.3.1.1-1: 2nd-stage SCI formats

|  |  |
| --- | --- |
| Value of 2nd-stage SCI format field | 2nd-stage SCI format |
| 00 | SCI format 2-A |
| 01 | SCI format 2-B; or  reserved if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured |
| 10 | SCI format 2-C; or  reserved if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured and the COT sharing flag field is set to '1' |
| 11 | SCI format 2-D; or  reserved if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured |

Table 8.3.1.1-2: Mapping of Beta\_offset indicator values to indexes in Table 9.3-2 of [5, TS38.213]

|  |  |
| --- | --- |
| Value of Beta\_offset indicator | Beta\_offset index in Table 9.3-2 of TS 38.213 [5] |
| 00 | 1st index provided by higher layer parameter *sl-BetaOffsets2ndSCI* |
| 01 | 2nd index provided by higher layer parameter *sl-BetaOffsets2ndSCI* |
| 10 | 3rd index provided by higher layer parameter *sl-BetaOffsets2ndSCI* |
| 11 | 4th index provided by higher layer parameter *sl-BetaOffsets2ndSCI* |

Table 8.3.1.1-3: Number of DMRS port(s)

|  |  |
| --- | --- |
| **Value of the Number of DMRS port field** | **Antenna ports** |
| 0 | 1000 |
| 1 | 1000 and 1001 |

#### 8.3.1.2 SCI format 1-B

SCI format 1-B is used for the scheduling of SL PRS for a dedicated SL PRS resource pool.

The following information is transmitted by means of the SCI format 1-B:

- Priority - 3 bits as specified in clause 5.7 of [12, TS 23.586] and clause 5.22 of [8, TS 38.321]. Value '000' of Priority field corresponds to priority value '1', value '001' of Priority field corresponds to priority value '2', and so on.

- Source ID – 12 or 24 bits determined by higher layer parameter *sl-SRC-ID-LenDedicatedSL-PRS-RP*, as defined in clause 16.4A of [5, TS 38.213].

- Destination ID – 24 bits as defined in clause 16.4A of [5, TS 38.213].

- Cast type indicator – 2 bits as defined in Table 8.3.1.2-1 and in clause 16.4A of [5, TS 38.213].

- Resource reservation period – bits as defined in clause 16.4A of [5, TS 38.213], where is the number of entries in the higher layer parameter *sl-PRS-ResourceReservePeriodList*, if higher layer parameter *sl-PRS-ResourceReservePeriodList* is configured; 0 bit otherwise.

- Time resource assignment – 5 bits when the value of the higher layer parameter *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is configured to 2; otherwise 9 bits when the value of the higher layer parameter *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is configured to 3, as defined in clause 8.2.4.2A of [6, TS 38.214].

- Resource ID indication –bits when the value of the higher layer parameter *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is configured to 2; otherwise bits when the value of the higher layer parameter *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is configured to 3. The value is the total number of SL PRS resources within a slot in a dedicated SL PRS resource pool and provided by the higher layer parameter *sl-PRS-ResourcesDedicatedSL-PRS-RP*.

- SL PRS request – 1 bit as defined in clause 8.4.4 of [6, TS 38.214] when the higher layer parameter *sl-SCI-basedSL-PRS-TxTriggerSCI1-B* is provided; 0 bit otherwise.

- Reserved - bits as configured by higher layer parameter *sl-NumReservedBitsSCI1B-DedicatedSL-PRS-RP*, with value set to zero.

Table 8.3.1.2-1: Cast type indicator

|  |  |
| --- | --- |
| Value of Cast type indicator | Cast type |
| 00 | Broadcast |
| 01 | Groupcast |
| 10 | Unicast |
| 11 | Reserved |

### 8.3.2 CRC attachment

CRC attachment is performed according to clause 7.3.2 except that scrambling is not performed.

### 8.3.3 Channel coding

Channel coding is performed according to clause 7.3.3.

### 8.3.4 Rate Matching

Rate matching is performed according to clause 7.3.4.

## 8.4 Sidelink control information on PSSCH

SCI carried on PSSCH is a 2nd-stage SCI, which transports sidelink scheduling information, and/or inter-UE coordination related information.

### 8.4.1 2nd-stage SCI formats

The fields defined in each of the 2nd-stage SCI formats below are mapped to the information bits to as follows:

Each field is mapped in the order in which it appears in the description, with the first field mapped to the lowest order information bit and each successive field mapped to higher order information bits. 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 .

#### 8.4.1.1 SCI format 2-A

SCI format 2-A is used for the decoding of PSSCH, with HARQ operation when HARQ-ACK information includes ACK or NACK, when HARQ-ACK information includes only NACK, or when there is no feedback of HARQ-ACK information.

The following information is transmitted by means of the SCI format 2-A:

- HARQ process number - bits.

- New data indicator - 1 bit.

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2.

- Source ID - 8 bits as defined in clause 8.1 of [6, TS 38.214].

- Destination ID - 16 bits as defined in clause 8.1 of [6, TS 38.214].

- HARQ feedback enabled/disabled indicator - 1 bit as defined in clause 16.3 of [5, TS 38.213].

- Cast type indicator - 2 bits as defined in Table 8.4.1.1-1 and in clause 8.1 of [6, TS 38.214].

- CSI request - 1 bit as defined in clause 8.2.1 of [6, TS 38.214] and in clause 8.1 of [6, TS 38.214].

If the 'COT sharing flag' field in SCI format 1-A is present and set to '1', all the remaining fields are set as follows:

- CAPC – 2 bits. Values '00', '01', '10' and '11' correspond to CAPC values '1', '2', '3' and '4' as defined in Table 4.5-1 of [14, TS 37.213], respectively.

- COT sharing cast type – 2 bits as defined in Table 8.4.1.1-1.

- COT sharing additional ID – 24 bits. The 16 LSBs provide layer 1 destination ID and the 8 MSBs provide layer 1 source ID, as defined in [6, TS 38.214]. The 8 MSBs are reserved when the COT sharing cast type field is set to '00' or '01'.

- Remaining COT duration – bits as defined in clause 4.5.3 of [14, TS 37.213], where is defined in Table 4.2-1 of Clause 4.2 of [4, TS 38.211].

Table 8.4.1.1-1: Cast type indicator or COT sharing cast type

|  |  |
| --- | --- |
| **Value of Cast type indicator or COT sharing cast type** | **Cast type** |
| 00 | Broadcast |
| 01 | Groupcast  when HARQ-ACK information includes ACK or NACK |
| 10 | Unicast |
| 11 | Groupcast  when HARQ-ACK information includes only NACK; or  reserved, if higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured |

#### 8.4.1.2 SCI format 2-B

SCI format 2-B is used for the decoding of PSSCH, with HARQ operation when HARQ-ACK information includes only NACK, or when there is no feedback of HARQ-ACK information.

The following information is transmitted by means of the SCI format 2-B:

- HARQ process number - bits.

- New data indicator - 1 bit.

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2.

- Source ID - 8 bits as defined in clause 8.1 of [6, TS 38.214].

- Destination ID - 16 bits as defined in clause 8.1 of [6, TS 38.214].

- HARQ feedback enabled/disabled indicator - 1 bit as defined in clause 16.3 of [5, TS 38.213].

- Zone ID - 12 bits as defined in clause 5.8.11 of [9, TS 38.331].

- Communication range requirement - 4 bits determined by higher layer parameter *sl-ZoneConfigMCR-Index*.

#### 8.4.1.3 SCI format 2-C

SCI format 2-C is used for the decoding of PSSCH, and providing inter-UE coordination information or requesting inter-UE coordination information. SCI format 2-C can be used only for unicast.

The following information is transmitted by means of the SCI format 2-C:

- HARQ process number - 4 bits

- New data indicator - 1 bit

- Redundancy version - 2 bits as defined in Table 7.3.1.1.1-2

- Source ID - 8 bits as defined in clause 8.1 of [6, TS 38.214]

- Destination ID - 16 bits as defined in clause 8.1 of [6, TS 38.214]

- HARQ feedback enabled/disabled indicator - 1 bit as defined in clause 16.3 of [5, TS 38.213]

- CSI request - 1 bit as defined in clause 8.2.1 of [6, TS 38.214] and in clause 8.1 of [6, TS 38.214]

- Providing/Requesting indicator - 1 bit, where value 0 indicates SCI format 2-C is used for providing inter-UE coordination information and value 1 indicates SCI format 2-C is used for requesting inter-UE coordination information

If the 'Providing/Requesting indicator' field is set to 0, all the remaining fields are set as follows:

- Resource combinations -number of bits determined by the following:

- If higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is not configured or configured to 'contigousRB'

- bits as defined in Clause 8.1.5A of [6, TS 38.214];

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'

- bits as defined in Clause 8.1.5A of [6, TS 38.214];

where

- and is the number of entries in the higher layer parameter *sl-ResourceReservePeriodList*, if higher layer parameter *sl-MultiReserveResource* is configured; otherwise.

- is provided by the higher layer parameter *sl-NumSubchannel* as defined in Clause 8.1.5 of [6, TS 38.214].

- is the number of RB sets in a resource pool.

- First resource location - 8 bits as defined in Clause 8.1.5A of [6, TS 38.214].

- Reference slot location - ( bits as defined in Clause 8.1.5A of [6, TS 38.214], where is defined in Table 4.2-1 of Clause 4.2 of [4, TS 38.211].

- Resource set type - 1 bit, where value 0 indicates preferred resource set and value 1 indicates non-preferred resource set.

- Lowest subChannel indices - bits as defined in Clause 8.1.5A of [6, TS 38.214].

- Lowest RB set indices - bits as defined in Clause 8.1.5A of [6, TS 38.214] if the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'; 0 bit otherwise.

If the 'Providing/Requesting indicator' field is set to 1, all the remaining fields are set as follows:

- Priority - 3 bits as specified in clause 5.4.3.3 of [12, TS 23.287] and clause 5.22.1.3.1 of [8, TS 38.321]. Value '000' of Priority field corresponds to priority value '1', value '001' of Priority field corresponds to priority value '2', and so on.

- Number of subchannels - bits as defined in Clause 8.1.4A of [6, TS 38.214].

- Number of RB sets - bits as defined in Clause 8.1.4A of [6, TS 38.214] if the higher layer parameter *transmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'; 0 bit otherwise.

- Resource reservation period - bits as defined in Clause 8.1.4A of [6, TS 38.214], where is the number of entries in the higher layer parameter *sl-ResourceReservePeriodList*, if higher layer parameter *sl-MultiReserveResource* is configured; 0 bit otherwise.

- Resource selection window location - bits as defined in Clause 8.1.4A of [6, TS 38.214], where is defined in Table 4.2-1 of Clause 4.2 of [4, TS 38.211].

- Resource set type - 1 bit, where value 0 indicates a request for inter-UE coordination information providing preferred resource set and value 1 indicates a request for inter-UE coordination information providing non-preferred resource set, if higher layer parameter *sl-DetermineResourceType* is configured to 'ueb'; otherwise, 0 bit.

- Padding bits.

For operation in a same resource pool, zeros shall be appended to SCI format 2-C of which 'Providing/Requesting indicator' field is set to 1 until the payload size equals that of SCI format 2-C of which 'Providing/Requesting indicator' field is set to 0.

#### 8.4.1.4 SCI format 2-D

SCI format 2-D is used for the decoding of PSSCH and the scheduling of SL PRS for a shared SL PRS resource pool.

The following information is transmitted by means of the SCI format 2-D:

- SL PRS resource ID -bits, where the value is the total number of SL PRS resource IDs within a slot in a shared SL PRS resource pool and provided by the higher layer parameter *sl-PRS-ResourcesSharedSL-PRS-RP*.

- SL PRS request – 1 bit as defined in clause 8.4.4 of [6, TS 38.214] when the higher layer parameter *sl-SCI-based-SL-PRS-Tx-Trigger-SCI2-D* is provided; 0 bit otherwise.

- Embedded SCI format - 2 bits. This field indicates the embedded SCI format as defined in Table 8.4.1.4-1.

- Embedded SCI format payload - number of bits determined according to Table 8.4.1.4-1. This field is set to the associated payload of the embedded SCI format indicated by the ‘Embedded SCI format’ field as defined in Table 8.4.1.4-1.

Table 8.4.1.4-1: Embedded SCI format and payload

|  |  |  |
| --- | --- | --- |
| **Value of the Embedded SCI format field** | **Embedded SCI format** | **Embedded SCI format payload** |
| 00 | SCI format 2-A | Set to all fields included in SCI format 2-A. Padding bits, if necessary, are appended to the 'Embedded SCI format payload' field untill the bitwidth equals the larger payload size of SCI format 2-A and SCI format 2-B. |
| 01 | SCI format 2-B | Set to all fields included in SCI format 2-B. Padding bits, if necessary, are appended to the 'Embedded SCI format payload' field untill the bitwidth equals the larger payload size of SCI format 2-A and SCI format 2-B. |
| 10 | Reserved | Reserved |
| 11 | Reserved | Reserved |

### 8.4.2 CRC attachment

CRC attachment is performed according to clause 7.3.2 except that scrambling is not performed.

### 8.4.3 Channel coding

Channel coding is performed according to clause 7.3.3.

### 8.4.4 Rate Matching

For 2nd-stage SCI transmission on PSSCH with SL-SCH, the number of coded modulation symbols generated for 2nd-stage SCI transmission prior to duplication for the 2nd layer if present, denoted as , is determined as follows:

where

-  is the number of the 2nd-stage SCI bits

-  is the number of CRC bits for the 2nd-stage SCI, which is 24 bits.

-  is indicated in the corresponding 1st-stage SCI.

- is the number of allocated PRBs of PSSCH transmission according to clause 8.1.3.2 in [6, TS 38.214], expressed as a number of subcarriers.

- is the number of subcarriers in OFDM symbol that carry PSCCH and PSCCH DMRS associated with the PSSCH transmission.

- is the number of resource elements that can be used for transmission of the 2nd-stage SCI in OFDM symbol , for and for , in PSSCH transmission, where = *sl-lengthSymbols* - 2, where *sl-lengthSymbols* is the number of sidelink symbols within the slot provided by higher layers as defined in [6, TS 38.214]. is the number of symbols for SL PRS provided by the higher layer parameter *numSym-SL-PRS-2ndStageSCI* if the 2nd-stage SCI is SCI format 2-D, and = 0 otherwise. If *startingSymbolFirst* and *startingSymbolSecond* are provided for the SL-BWP, = *numRefSymbolLength* - 2, where *numRefSymbolLength* is provided by higher layers. If higher layer parameter *sl-PSFCH-Period* = 2 or 4, = 3 if "PSFCH overhead indication" field of SCI format 1-A indicates "1", and = 0 otherwise. If higher layer parameter *sl-PSFCH-Period* = 0, . If higher layer parameter *sl-PSFCH-Period* is 1, .

- = -

- is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.

- is the coding rate as indicated by "Modulation and coding scheme" field in SCI format 1-A.

- is configured by higher layer parameter *sl-Scaling*.

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

Rate matching is performed according to Clause 5.4.1 by setting .

The output bit sequence after rate matching is denoted as , where and is modulation order of the 2nd-stage SCI. A UE is not expected to have.

### 8.4.5 Multiplexing of coded 2nd-stage SCI bits to PSSCH

The coded 2nd-stage SCI bits are multiplexed onto PSSCH according to the procedures in Clause 8.2.1.

Annex A (informative):  
Change history

| Change history | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2017-05 | RAN1#89 | R1-1707082 |  |  |  | Draft skeleton | 0.0.0 |
| 2017-07 | AH\_NR2 | R1-1712014 |  |  |  | Inclusion of LDPC related agreements | 0.0.1 |
| 2017-08 | RAN1#90 | R1-1714564 |  |  |  | Inclusion of Polar coding related agreements | 0.0.2 |
| 2017-08 | RAN1#90 | R1-1714659 |  |  |  | Endorsed version by RAN1#90 as basis for further updates | 0.1.0 |
| 2017-09 | RAN1#90 | R1-1715322 |  |  |  | Capturing additional agreements on LDPC and Polar code from RAN1 #90 | 0.1.1 |
| 2017-09 | RAN#77 | RP-171991 |  |  |  | For information to plenary | 1.0.0 |
| 2017-09 | RAN1#90b | R1-1716928 |  |  |  | Capturing additional agreements on LDPC and Polar code from RAN1 NR AH#3 | 1.0.1 |
| 2017-10 | RAN1#90b | R1-1719106 |  |  |  | Endorsed as v1.1.0 | 1.1.0 |
| 2017-11 | RAN1#91 | R1-1719225 |  |  |  | Capturing additional agreements on channel coding, etc. | 1.1.1 |
| 2017-11 | RAN1#91 | R1-1719245 |  |  |  | Capturing additional agreements on DCI format, channel coding, etc. | 1.1.2 |
| 2017-11 | RAN1#91 | R1-1721049 |  |  |  | Endorsed as v1.2.0 | 1.2.0 |
| 2017-12 | RAN1#91 | R1-1721342 |  |  |  | Capturing additional agreements on UCI, DCI, channel coding, etc. | 1.2.1 |
| 2017-12 | RAN#78 | RP-172668 |  |  |  | Endorsed version for approval by plenary. | 2.0.0 |
| 2017-12 | RAN#78 |  |  |  |  | Approved by plenary - Rel-15 spec under change control | 15.0.0 |
| 2018-03 | RAN#79 | RP-180200 | 0001 | - | F | CR capturing the Jan18 ad-hoc and RAN1#92 meeting agreements | 15.1.0 |
| 2018-04 | RAN#79 |  |  |  |  | MCC: correction of typo in DCI format 0\_1 (time domain resource assignment) - higher layer parameter should be *pusch-AllocationList* | 15.1.1 |
| 2018-06 | RAN#80 | RP-181172 | 0002 | 1 | F | CR to 38.212 capturing the RAN1#92bis and RAN1#93 meeting agreements | 15.2.0 |
| 2018-06 | RAN#80 | RP-181257 | 0003 | - | B | CR to 38.212 capturing the RAN1#92bis and RAN1#93 meeting agreements related to URLLC | 15.2.0 |
| 2018-09 | RAN#81 | RP-181789 | 0004 | - | F | CR to 38.212 capturing the RAN1#94 meeting agreements | 15.3.0 |
| 2018-12 | RAN#82 | RP-182523 | 0005 | 3 | F | Combined CR of all essential corrections to 38.212 from RAN1#94bis and RAN1#95 | 15.4.0 |
| 2019-03 | RAN#83 | RP-190448 | 0006 | - | F | Correction of wrong implementation on frequency domain resource assignment bitwidth | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0008 | - | F | Correction to UCI multiplexing | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0009 | - | F | Correction on DCI format 2\_3 for SUL cell in TS 38.212 | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0010 | - | F | Corrections to TS38.212 | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0011 | - | F | On bitwidth calculation for DCI fields using RRC parameter indicating maximum number of MIMO layers per serving cell | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0012 | - | F | CR on zero-padding of DCI 1\_1 in cross-carrier scheduling case | 15.5.0 |
| 2019-03 | RAN#83 | RP-190448 | 0013 | - | F | Clarification on UL\_SUL indicator field and SRS request field | 15.5.0 |
| 2019-06 | RAN#84 | RP-191282 | 0014 | - | F | CR on correction to bitwidth of NNZC indicator | 15.6.0 |
| 2019-06 | RAN#84 | RP-191282 | 0015 | - | F | Correction on DCI size alignment in TS 38.212 | 15.6.0 |
| 2019-06 | RAN#84 | RP-191282 | 0016 | - | F | Correction on UL/SUL indicator in DCI format 0\_0 | 15.6.0 |
| 2019-06 | RAN#84 | RP-191282 | 0017 | - | F | Corrections to 38.212 including alignment of terminology across specifications | 15.6.0 |
| 2019-06 | RAN#84 | RP-191282 | 0018 | - | F | CR on maximum modulation order configured for serving cell | 15.6.0 |
| 2019-06 | RAN#84 | RP-191282 | 0019 | 1 | F | Corrections to 38.212 including alignment of terminology across specifications from RAN1#97 | 15.6.0 |
| 2019-09 | RAN#85 | RP-191941 | 0020 | - | F | Corrections to 38.212 including alignment of terminology across specifications in RAN1#98 | 15.7.0 |
| 2019-12 | RAN#86 | RP-192625 | 0021 | - | F | CR on UL/SUL indicator in DCI format 0\_1 | 15.8.0 |
| 2019-12 | RAN#86 | RP-192625 | 0022 | - | F | Corrections to 38.212 including alignment of terminology across specifications in RAN1#98bis and RAN1#99 | 15.8.0 |
| 2019-12 | RAN#86 | RP-192636 | 0023 | - | B | Introduction of NR based access to unlicensed spectrum into 38.212 | 16.0.0 |
| 2019-12 | RAN#86 | RP-192637 | 0024 | - | B | Introduction of IAB into 38.212 | 16.0.0 |
| 2019-12 | RAN#86 | RP-192638 | 0025 | - | B | Introduction of 5G V2X sidelink features into TS 38.212 | 16.0.0 |
| 2019-12 | RAN#86 | RP-192639 | 0026 | - | B | Introduction of Physical Layer Enhancements for NR URLLC | 16.0.0 |
| 2019-12 | RAN#86 | RP-192641 | 0027 | - | B | Introduction of Enhancements on NR MIMO | 16.0.0 |
| 2019-12 | RAN#86 | RP-192642 | 0028 | - | B | Introduction of power saving in 38.212 | 16.0.0 |
| 2019-12 | RAN#86 | RP-192645 | 0029 | - | B | Introduction of MR DC/CA | 16.0.0 |
| 2019-12 | RAN#86 | RP-192643 | 0030 | - | B | Introduction of NR positioning support | 16.0.0 |
| 2019-12 | RAN#86 | RP-192635 | 0031 | - | B | Introduction of two-step RACH | 16.0.0 |
| 2020-03 | RAN#87-e | RP-200185 | 0032 | - | F | Corrections for Rel-16 NR-U after RAN1#100-e | 16.1.0 |
| 2020-03 | RAN#87-e | RP-200190 | 0033 | - | F | Corrections for NR MIMO after RAN1#100-e | 16.1.0 |
| 2020-03 | RAN#87-e | RP-200188 | 0034 | - | F | Corrections for URLLC after RAN1#100-e | 16.1.0 |
| 2020-03 | RAN#87-e | RP-200191 | 0035 | - | F | Corrections for power saving after RAN1#100-e | 16.1.0 |
| 2020-03 | RAN#87-e | RP-200187 | 0036 | - | F | Corrections on 5G V2X sidelink features after RAN1#100-e | 16.1.0 |
| 2020-06 | RAN#88-e | RP-200683 | 0038 | - | A | CR on L1-RSRP report on PUSCH | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200693 | 0039 | 1 | F | Corrections for power saving | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200689 | 0040 | 1 | F | Corrections on 5G V2X sidelink features after RAN1#100bis-e and RAN1#101-e | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200694 | 0041 | 1 | F | Corrections in TS 38.212 for NR positioning | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200692 | 0042 | 1 | F | Corrections in TS 38.212 for NR MIMO | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200696 | 0043 | - | F | Corrections for Rel-16 MR-DC/CA after RAN1#100bis-e | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200690 | 0044 | 1 | F | Corrections on NR eURLLC | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200687 | 0045 | 1 | F | Corrections for Rel-16 NR-U | 16.2.0 |
| 2020-06 | RAN#88-e | RP-200688 | 0046 | - | F | Corrections for NR IAB | 16.2.0 |
| 2020-09 | RAN#89-e | RP-201814 | 0047 | - | F | Correction on UCI bit sequence generation | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201803 | 0049 | - | A | CR on PTRS for TS 38.212 | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201810 | 0050 | - | F | Alignment of RRC parameter *ps-RNTI* | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201813 | 0051 | - | F | CR to 38.212 on RRC parameter alignment for SCell dormancy | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201807 | 0052 | - | F | Corrections on 5G V2X sidelink features | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201809 | 0053 | - | F | Corrections to MIMO enhancements | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201805 | 0054 | - | F | Corrections to MIMO enhancements | 16.3.0 |
| 2020-09 | RAN#89-e | RP-201808 | 0055 | - | F | Corrections on NR eURLLC | 16.3.0 |
| 2020-12 | RAN#90-e | RP-202390 | 0056 | - | F | RRC IE name fix to dynamic frequency domain resource allocation type selection (Rel-15 origin) | 16.4.0 |
| 2020-12 | RAN#90-e | RP-202384 | 0057 | - | F | Correction on Transmission configuration indication in DCI format 1\_2 | 16.4.0 |
| 2020-12 | RAN#90-e | RP-202398 | 0058 | - | F | Alignment CR for TS 38.212 | 16.4.0 |
| 2021-03 | RAN#91-e | RP-210052 | 0059 | - | F | CR on DMRS | 16.5.0 |
| 2021-03 | RAN#91-e | RP-210049 | 0060 | - | F | Correction to description of FDRA field size in DCI 0\_0 | 16.5.0 |
| 2021-03 | RAN#91-e | RP-210049 | 0061 | - | F | Correction to description of FDRA field interpretation in DCI 0\_1 | 16.5.0 |
| 2021-03 | RAN#91-e | RP-210050 | 0062 | - | F | Correction on Sidelink Broadcast channel | 16.5.0 |
| 2021-03 | RAN#91-e | RP-210049 | 0063 | - | F | Correction on LBT Type and CP Extension Indication for Semi-Static Channel Occupancy | 16.5.0 |
| 2021-03 | RAN#91-e | RP-210059 | 0064 | - | F | Alignment CR for TS 38.212 | 16.5.0 |
| 2021-06 | RAN#92-e | RP-211252 | 0066 | - | F | 38.212 CR on DAI size determination for DCI format 1\_1/1-2 in CA | 16.6.0 |
| 2021-06 | RAN#92-e | RP-211236 | 0067 | - | F | Corrections on parameter of MCS table set to qam256 | 16.6.0 |
| 2021-06 | RAN#92-e | RP-211234 | 0068 | - | D | Alignment CR for TS 38.212 (post RAN1#104bis-e) | 16.6.0 |
| 2021-06 | RAN#92-e | RP-211234 | 0069 | - | F | Correction on HARQ-ACK codebook RRC parameter | 16.6.0 |
| 2021-06 | RAN#92-e | RP-211236 | 0070 | - | F | Correction on SRS resource set configuration in TS 38.212 | 16.6.0 |
| 2021-06 | RAN#92-e | RP-211243 | 0071 | - | F | Alignment CR for TS 38.212 (post RAN1#105-e) | 16.6.0 |
| 2021-09 | RAN#93-e | RP-211843 | 0072 | - | F | Correction on SRS resource set configuration for DCI format 0\_2 in TS 38.212 | 16.7.0 |
| 2021-09 | RAN#93-e | RP-211841 | 0074 | - | A | Rel-15 editorial corrections for TS 38.212 (mirrored to Rel-16) | 16.7.0 |
| 2021-09 | RAN#93-e | RP-211850 | 0075 | - | F | Alignment CR for TS 38.212 | 16.7.0 |
| 2021-12 | RAN#94-e | RP-212959 | 0076 | - | F | Correction on mapping between priority field value and priority value in SCI format 1-A | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212961 | 0077 | - | F | Changes of channel access types tables in TS 38.212 | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212961 | 0078 | - | F | Corrections on CG-UCI multiplexing in TS38.212 | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212958 | 0080 | - | A | Clarify UCI bitwidth and UCI mapping order for non-PMI based CSI feedback | 16.8.0 |
| 2021-12 | RAN#94-e | RP-213238 | 0081 | - | F | Clarification on KNZ to codepoint mapping for eType II CSI | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212958 | 0083 | - | A | Rel-15 editorial corrections for TS 38.212 (mirrored to Rel-16) | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212964 | 0084 | - | F | Alignment CR for TS 38.212 | 16.8.0 |
| 2021-12 | RAN#94-e | RP-212967 | 0085 | - | B | Introduction of features to extend current NR operation to 71 GHz | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212982 | 0086 | - | B | Introduction of NR DL 1024QAM for FR1 | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212973 | 0087 | - | B | Introduction of Coverage Enhancements | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212979 | 0088 | - | B | Introduction of NR Multicast and Broadcast Services | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212966 | 0089 | - | B | Introduction of Further enhancements on MIMO for NR | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212969 | 0090 | - | B | Introduction of NR non-terrestrial networks (NTN) | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212972 | 0091 | - | B | Introduction of Rel-17 UE power saving enhancements | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212968 | 0092 | - | B | Introduction of Rel-17 enhanced IIoT and URLLC | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212980 | 0093 | - | B | Introduction of NR dynamic spectrum sharing enhancements | 17.0.0 |
| 2021-12 | RAN#94-e | RP-212978 | 0094 | - | B | Introduction of NR sidelink enhancement | 17.0.0 |
| 2022-03 | RAN#95-e | RP-220269 | 0096 | - | A | Correction of NZC partitioning in eType II CSI | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220248 | 0098 | - | A | Correction on Rel-16 UE dormancy adaptation | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220252 | 0099 | - | F | Corrections on enhanced IIoT and URLLC in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220262 | 0100 | - | F | Corrections on NR sidelink enhancement in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220257 | 0101 | - | F | Corrections on coverage enhancements in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220263 | 0102 | - | F | Corrections on NR Multicast and Broadcast Services in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220256 | 0103 | - | F | Corrections on UE power saving enhancements in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220251 | 0104 | - | F | Correction on extension of current NR operation to 71 GHz in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220264 | 0105 | - | F | Corrections on NR dynamic spectrum sharing enhancements in 38.212 | 17.1.0 |
| 2022-03 | RAN#95-e | RP-220250 | 0106 | - | F | Corrections on Further enhancements on MIMO for NR in TS 38.212 | 17.1.0 |
| 2022-06 | RAN#96 | RP-221617 | 0108 | - | A | Clarification of TPMI indication for UL full power transmission | 17.2.0 |
| 2022-06 | RAN#96 | RP-221602 | 0109 | - | F | Corrections on enhanced IIoT and URLLC in 38.212 | 17.2.0 |
| 2022-06 | RAN#96 | RP-221612 | 0110 | - | F | Corrections on NR Multicast and Broadcast Services in 38.212 | 17.2.0 |
| 2022-06 | RAN#96 | RP-221606 | 0111 | - | F | Corrections on UE power saving enhancements in 38.212 | 17.2.0 |
| 2022-06 | RAN#96 | RP-221601 | 0112 | - | F | Correction on extension of current NR operation to 71 GHz in 38.212 | 17.2.0 |
| 2022-06 | RAN#96 | RP-221600 | 0113 | - | F | Corrections on Further enhancements on MIMO for NR in TS 38.212 | 17.2.0 |
| 2022-06 | RAN#96 | RP-221599 | 0115 | - | A | Rel-16 editorial corrections for TS 38.212 (mirrored to Rel-17) | 17.2.0 |
| 2022-09 | RAN#97-e | RP-222403 | 0116 | 1 | F | CR on DCI size for Rel-17 NTN HARQ in 38.212 | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222400 | 0117 | - | F | CR on the description of the SRS resource set indication for PUSCH repetition | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222401 | 0118 | - | F | CR on ChannelAccess-Cpext in Fallback DCI | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222413 | 0119 | - | F | CR on DCI size alignment for Cross-carrier scheduling from SCell to PCell | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222406 | 0120 | - | F | Corrections on UE Power Saving Enhancements for NR in TS 38.212 | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222412 | 0121 | - | F | Corrections on NR Multicast and Broadcast Services in 38.212 | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222411 | 0122 | - | F | Correction on NR sidelink enhancement | 17.3.0 |
| 2022-09 | RAN#97-e | RP-222422 | 0123 | - | F | Rel-17 editorial corrections for TS 38.212 | 17.3.0 |
| 2022-12 | RAN#98-e | RP-222863 | 0124 | - | F | Corrections on resource pool index | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222853 | 0125 | - | F | CR on channel access type indication in non-fallback DCI | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222853 | 0126 | - | F | Correction to support up to 32 HARQ process numbers for FR2-2 | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222853 | 0127 | - | F | Correction on TDRA for multiple PUSCH scheduling in TS 38.212 | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222854 | 0128 | - | F | CR on priority of CG-UCI | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222864 | 0129 | - | F | CR on number of HARQ-ACK codebooks configurable for multicast | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222865 | 0130 | - | F | CR on DCI size alignment for Cross-carrier schduling from SCell to PCell | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222868 | 0131 | 1 | F | Rel-17 editorial corrections for TS 38.212 | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222858 | 0132 | - | F | Correction on the short message indicator when TRS availability indication is present | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222864 | 0133 | - | F | CR on format 4\_0 DCI size alignment in SCell | 17.4.0 |
| 2022-12 | RAN#98-e | RP-222870 | 0134 | - | F | CR on CSI reporting | 17.4.0 |
| 2023-03 | RAN#99 | RP-230451 | 0135 | - | F | CR on aligning DCI sizes when configuring two HARQ-ACK codebooks for multicast | 17.5.0 |
| 2023-03 | RAN#99 | RP-230443 | 0136 | - | F | Corrections on intra-UE multiplexing and semi-static channel occupancy | 17.5.0 |
| 2023-03 | RAN#99 | RP-230442 | 0137 | - | F | CR on DCI field sizes for multiple PDSCHs scheduled by single DCI | 17.5.0 |
| 2023-03 | RAN#99 | RP-230442 | 0138 | - | F | Corrections to ChanneAccess-CPext field in DCI formats x\_2 in TS38.212 | 17.5.0 |
| 2023-03 | RAN#99 | RP-230440 | 0140 | - | A | Rel-16 editorial corrections for TS 38.212 (mirrored to Rel-17) | 17.5.0 |
| 2023-03 | RAN#99 | RP-230453 | 0141 | - | F | Rel-17 editorial corrections for TS 38.212 | 17.5.0 |
| 2023-09 | RAN#101 | RP-232445 | 0142 | - | F | Correction for the mapping of rank combination value for Rel-17 NCJT CSI | 17.6.0 |
| 2023-09 | RAN#101 | RP-232531 | 0143 | - | F | Rel-17 editorial corrections for TS 38.212 | 17.6.0 |
| 2023-09 | RAN#101 | RP-232471 | 0144 | - | B | Introduction of Rel-18 Multi-carrier enhancements | 18.0.0 |
| 2023-09 | RAN#101 | RP-232458 | 0145 | - | B | Introduction of Rel-18 MIMO Evolution for Downlink and Uplink | 18.0.0 |
| 2023-09 | RAN#101 | RP-232473 | 0146 | - | B | Introduction of Rel-18 Further NR mobility enhancements | 18.0.0 |
| 2023-09 | RAN#101 | RP-232474 | 0147 | - | B | Introduction of Rel-18 NR NTN enhancements | 18.0.0 |
| 2023-09 | RAN#101 | RP-232480 | 0148 | - | B | Introduction of NR positioning enhancement in Rel-18 | 18.0.0 |
| 2023-09 | RAN#101 | RP-232469 | 0149 | - | B | Introduction of Rel-18 NR sidelink evolution | 18.0.0 |
| 2023-09 | RAN#101 | RP-232479 | 0150 | - | B | Introduction of Rel-18 network controlled repeaters | 18.0.0 |
| 2023-09 | RAN#101 | RP-232481 | 0151 | - | B | Introduction of Rel-18 network energy saving for NR | 18.0.0 |
| 2023-09 | RAN#101 | RP-232472 | 0152 | - | B | Introduction of Rel-18 further NR Coverage enhancement | 18.0.0 |
| 2023-09 | RAN#101 | RP-232477 | 0154 | - | B | Introduction of Rel-18 NR support for dedicated spectrum less than 5MHz for FR1 | 18.0.0 |
| 2023-09 | RAN#101 | RP-232482 | 0155 | - | B | Introduction of Rel-18 XR enhancements for NR | 18.0.0 |
| 2023-12 | RAN#102 | RP-233703 | 0158 | 1 | A | Correction on the rate matching when HARQ-ACK multiplexed with CG-PUSCH | 18.1.0 |
| 2023-12 | RAN#102 | RP-233727 | 0160 | - | A | Correction on CSI reporting for 1 CSI-RS port | 18.1.0 |
| 2023-12 | RAN#102 | RP-233728 | 0162 | - | A | Rel-17 editorial corrections for TS 38.212 (mirrored to Rel-18) | 18.1.0 |
| 2023-12 | RAN#102 | RP-233719 | 0163 | - | F | Corrections on NR positioning enhancement in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233706 | 0164 | - | F | Corrections on Rel-18 NR sidelink evolution in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233709 | 0165 | - | F | Corrections on Rel-18 further NR Coverage enhancement in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233710 | 0166 | - | F | Corrections on Rel-18 Further NR mobility enhancements in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233705 | 0167 | - | F | Corrections on Rel-18 MIMO Evolution for Downlink and Uplink in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233708 | 0168 | - | F | Corrections on Rel-18 Multi-carrier enhancements in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233720 | 0169 | - | F | Corrections on Rel-18 network energy saving for NR in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233714 | 0170 | - | F | Corrections on Rel-18 NR NTN enhancements in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233721 | 0171 | - | F | Corrections on Rel-18 XR enhancements for NR in 38.212 | 18.1.0 |
| 2023-12 | RAN#102 | RP-233729 | 0172 | - | B | Introduction of Rel-18 NR demodulation performance evoluation | 18.1.0 |
| 2023-12 | RAN#102 | RP-233733 | 0173 | - | B | Introduction of Rel-18 enhancements of NR Multicast and Broadcast Services | 18.1.0 |
| 2023-12 | RAN#102 | RP-233718 | 0174 | - | F | Corrections on Rel-18 network controlled repeaters in 38.212 | 18.1.0 |
| 2024-03 | RAN#103 | RP-240534 | 0176 | - | A | Clarification on typeA SRS TPC commands for SUL | 18.2.0 |
| 2024-03 | RAN#103 | RP-240515 | 0178 | - | A | CR on reportQuantity for RSRP/SINR in TS38.212 | 18.2.0 |
| 2024-03 | RAN#103 | RP-240530 | 0179 | - | F | Correction of RRC parameter names for UTO-UCI indication | 18.2.0 |
| 2024-03 | RAN#103 | RP-240536 | 0181 | - | A | Rel-16 editorial corrections for TS 38.212 (mirrored to Rel-18) | 18.2.0 |
| 2024-03 | RAN#103 | RP-240537 | 0183 | - | F | Rel-18 editorial corrections for TS 38.212 | 18.2.0 |
| 2024-03 | RAN#103 | RP-240520 | 0184 | - | F | Corrections on Rel-18 Multi-carrier enhancements in 38.212 | 18.2.0 |
| 2024-03 | RAN#103 | RP-240518 | 0185 | - | F | Corrections on Rel-18 MIMO Evolution for Downlink and Uplink in 38.212 | 18.2.0 |
| 2024-03 | RAN#103 | RP-240528 | 0186 | - | F | Corrections on NR positioning enhancement in 38.212 | 18.2.0 |
| 2024-03 | RAN#103 | RP-240519 | 0187 | - | F | Corrections on Rel-18 NR sidelink evolution in 38.212 | 18.2.0 |