**3GPP TSG RAN WG1 #119R1-24xxxxx**

**Orlando, FL, USA, November 18 – 22, 2024**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.211** | **CR** | **0146** | **rev** | **1** | **Current version:** | **18.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Alignment of parameter names | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Core, NR\_Mob\_enh2-Core | | | | |  | ***Date:*** | | | 2024-11-25 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | * Ambiguous description of intermediate resources for antenna port mapping. (R1-2407789) * Enhanced DM-RS pattern for PDSCH should, according to RAN1 agreements, not be supported for DCI formats 1\_0, 4\_0, and 4\_1 * Incorrect and missing higher-layer parameter names for LTM (R1-2410123, R1-2410771) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Clarification of the intermediate resoruce. * Clarificatio of the DM-RS pattern generation * Correction of higher-layer parameter name | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | * Ambiguous specification. * Specifications not in line with the RAN1 agreements * Inconsistent and incomplete specifications | | | | | | | | |
|  | | 5.3.2, | | | | | | | | |
| ***Clauses affected:*** | | 6.3.3.1, 6.3.3.2, 6.4.1.1.3. 7.4.1.1.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### 5.3.2 OFDM baseband signal generation for PRACH

The time-continuous signal  on antenna port for PRACH is defined by

where  and

-  is given by clause 6.3.3;

- is the subcarrier spacing of the initial uplink bandwidth part during initial access. If the PRACH transmission is for a candidate cell is provided by *ltm-PRACH-SubcarrierSpacing* in *EarlyUL-SyncConfig*. Otherwise,  is the subcarrier spacing of the active uplink bandwidth part;

- is the largest value among the subcarrier spacing configurations by the higher-layer parameter *scs-SpecificCarrierList*;

-  is the lowest numbered resource block of the initial uplink bandwidth part and is derived by the higher-layer parameter *initialUplinkBWP* or *initialUplinkBWP-RedCap* during initial access and from the higher-layer parameters *bwp-GenericParameters* in *EarlyUL-SyncConfig* if the PRACH transmission is for a candidate cell. Otherwise,  is the lowest numbered resource block of the active uplink bandwidth part and is derived by the higher-layer parameter *BWP-Uplink*;

- is the frequency offset of the lowest PRACH transmission occasion in frequency domain with respect to physical resource block 0 of the active uplink bandwidth part. The quantity is given by the higher-layer parameter *msgA-RO-FrequencyStart* if configured and a type-2 random-access procedure is initiated as described in clause 8.1 of [5, TS 38.213], otherwise by *msg1-FrequencyStart* as described in clause 8.1 of [5 TS 38.213];

-  is the PRACH transmission occasion index in frequency domain for a given PRACH transmission occasion in one time instance as given by clause 6.3.3.2;

-  is the number of resource blocks occupied and is given by the parameter allocation expressed in number of RBs for PUSCH in Table 6.3.3.2-1.

- is the start CRB index of uplink RB set corresponding to the quantity . The UE assumes that the RB set is defined as when the UE is not provided *IntraCellGuardBandsPerSCS* for an UL carrier as described in Clause 7 of [6, TS 38.214]

- is the index of the RB set which contains the lowest PRACH transmission occasion in frequency domain indicated by . The UE may assume that is configured such that each PRACH transmission occasion is fully contained within an RB set.

-  and  are given by clause 6.3.3

- where

- for ,

- for kHz, is the number of times the interval overlaps with either time instance 0 or time instance  in a subframe

The starting position of the PRACH preamble in a subframe (for ) or in a 60 kHz slot (for kHz) is given by



where

- the subframe or 60 kHz slot is assumed to start at ;

- a timing advance value shall be assumed;

- and are given by clause 5.3.1;

-  shall be assumed for kHz, otherwise the value of corresponds to kHz and the symbol position  is given by

where

-  is given by the parameter "starting symbol" in Tables 6.3.3.2-2 to 6.3.3.2-4;

-  is the PRACH transmission occasion within the PRACH slot, numbered in increasing order from 0 to  within a RACH slot where  is given Tables 6.3.3.2-2 to 6.3.3.2-4 for and fixed to 1 for ;

-  is given by Tables 6.3.3.2-2 to 6.3.3.2-4;

-  is given by

- if kHz, then 

- if kHz and either of "Number of PRACH slots within a subframe" in Tables 6.3.3.2-2 to 6.3.3.2-3 or "Number of PRACH slots within a 60 kHz slot" in Table 6.3.3.2-4 is equal to 1, then , otherwise

- if kHz and

- the "Number of PRACH slots within a 60 kHz slot" in Table 6.3.3.2-4 is equal to 1, then for kHz and for kHz, or

- the "Number of PRACH slots within a 60 kHz slot" in Table 6.3.3.2-4 is equal to 2, then for kHz and for kHz.

If the preamble format given by Tables 6.3.3.2-2 to 6.3.3.2-4 is A1/B1, A2/B2 or A3/B3, then

- if , then the PRACH preamble with the corresponding PRACH preamble format from B1, B2 and B3 is transmitted in the PRACH transmission occasion;

- otherwise the PRACH preamble with the corresponding PRACH preamble format from A1, A2 and A3 is transmitted in the PRACH transmission occasion

#### 6.3.3.1 Sequence generation

The set of random-access preambles  shall be generated according to



from which the frequency-domain representation shall be generated according to



where , , , or depending on the PRACH preamble format as given by Tables 6.3.3.1-1 and 6.3.3.1-2.

There are 64 preambles defined in each time-frequency PRACH occasion, enumerated in increasing order of first increasing cyclic shift  of a logical root sequence, and then in increasing order of the logical root sequence index, starting with the index obtained from the higher-layer parameter *prach-RootSequenceIndex* or *rootSequenceIndex-BFR* or by *msgA-PRACH-RootSequenceIndex* if configured and a type-2 random-access procedure is initiated as described in clause 8.1 of [5, TS 38.213] or by *prach-RootSequenceIndex* in *EarlyUL-SyncConfig* if the PRACH transmission is for a candidate cell . Additional preamble sequences, in case 64 preambles cannot be generated from a single root Zadoff-Chu sequence, are obtained from the root sequences with the consecutive logical indexes until all the 64 sequences are found. The logical root sequence order is cyclic; the logical index 0 is consecutive to . The sequence number  is obtained from the logical root sequence index according to Tables 6.3.3.1-3 to 6.3.3.1-4B.

The cyclic shift  is given by



where  is given by Tables 6.3.3.1-5 to 6.3.3.1-7. The type of restricted sets (unrestricted, restricted type A, restricted type B) is given by

- the higher-layer parameter *msgA-RestrictedSetConfig*, if provided;

- or the higher-layer parameter *ltm-restrictedSetConfig* associated with a candidate cell indicated in Cell indicator field of a PDCCH order, if provided;

- otherwise, the higher-layer parameter *restrictedSetConfig.*

Tables 6.3.3.1-1 and 6.3.3.1-2 indicate the type of restricted sets supported for the different preamble formats.

The variable  is given by



where  is the smallest non-negative integer that fulfils . The parameters for restricted sets of cyclic shifts depend on .

For restricted set type A, the parameters are given by:

- for 



- for 



For restricted set type B, the parameters are given by:

- for 



- for 



- for 



- for 



- for 



- for 



For all other values of , there are no cyclic shifts in the restricted set.

Table 6.3.3.1-1: PRACH preamble formats for  and kHz.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Format |  |  |  |  | Support for restricted sets |
| 0 | 839 | 1.25 kHz |  |  | Type A, Type B |
| 1 | 839 | 1.25 kHz |  |  | Type A, Type B |
| 2 | 839 | 1.25 kHz |  |  | Type A, Type B |
| 3 | 839 | 5 kHz |  |  | Type A, Type B |

Table 6.3.3.1-2: Preamble formats for and kHz where .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Format |  | | |  |  |  | Support for restricted sets |
|  |  |  |
| A1 | 139 | 1151 | 571 |  |  |  | - |
| A2 | 139 | 1151 | 571 |  |  |  | - |
| A3 | 139 | 1151 | 571 |  |  |  | - |
| B1 | 139 | 1151 | 571 |  |  |  | - |
| B2 | 139 | 1151 | 571 |  |  |  | - |
| B3 | 139 | 1151 | 571 |  |  |  | - |
| B4 | 139 | 1151 | 571 |  |  |  | - |
| C0 | 139 | 1151 | 571 |  |  |  | - |
| C2 | 139 | 1151 | 571 |  |  |  |  |

Table 6.3.3.1-3: Mapping from *logical index*  to sequence number  for preamble formats with .

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

Table 6.3.3.1-4: Mapping from *logical index*  to sequence number  for preamble formats with .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sequence number  in increasing order of | | | | | | | | | | | | | | | | | | | |
| 0 – 19 | 1 | 138 | 2 | 137 | 3 | 136 | 4 | 135 | 5 | 134 | 6 | 133 | 7 | 132 | 8 | 131 | 9 | 130 | 10 | 129 |
| 20 – 39 | 11 | 128 | 12 | 127 | 13 | 126 | 14 | 125 | 15 | 124 | 16 | 123 | 17 | 122 | 18 | 121 | 19 | 120 | 20 | 119 |
| 40 – 59 | 21 | 118 | 22 | 117 | 23 | 116 | 24 | 115 | 25 | 114 | 26 | 113 | 27 | 112 | 28 | 111 | 29 | 110 | 30 | 109 |
| 60 – 79 | 31 | 108 | 32 | 107 | 33 | 106 | 34 | 105 | 35 | 104 | 36 | 103 | 37 | 102 | 38 | 101 | 39 | 100 | 40 | 99 |
| 80 – 99 | 41 | 98 | 42 | 97 | 43 | 96 | 44 | 95 | 45 | 94 | 46 | 93 | 47 | 92 | 48 | 91 | 49 | 90 | 50 | 89 |
| 100 – 119 | 51 | 88 | 52 | 87 | 53 | 86 | 54 | 85 | 55 | 84 | 56 | 83 | 57 | 82 | 58 | 81 | 59 | 80 | 60 | 79 |
| 120 – 137 | 61 | 78 | 62 | 77 | 63 | 76 | 64 | 75 | 65 | 74 | 66 | 73 | 67 | 72 | 68 | 71 | 69 | 70 | - | - |
| 138 – 837 | N/A | | | | | | | | | | | | | | | | | | | |

Table 6.3.3.1-4A: Mapping from *logical index* to sequence number for preamble formats with .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sequence number in increasing order of | | | | | | | | | | | | | | | | | | | |
| 0-19 | 1 | 1150 | 2 | 1149 | 3 | 1148 | 4 | 1147 | 5 | 1146 | 6 | 1145 | 7 | 1144 | 8 | 1143 | 9 | 1142 | 10 | 1141 |
| 20-39 | 11 | 1140 | 12 | 1139 | 13 | 1138 | 14 | 1137 | 15 | 1136 | 16 | 1135 | 17 | 1134 | 18 | 1133 | 19 | 1132 | 20 | 1131 |
| 40-59 | 21 | 1130 | 22 | 1129 | 23 | 1128 | 24 | 1127 | 25 | 1126 | 26 | 1125 | 27 | 1124 | 28 | 1123 | 29 | 1122 | 30 | 1121 |
| 60-79 | 31 | 1120 | 32 | 1119 | 33 | 1118 | 34 | 1117 | 35 | 1116 | 36 | 1115 | 37 | 1114 | 38 | 1113 | 39 | 1112 | 40 | 1111 |
| 80-99 | 41 | 1110 | 42 | 1109 | 43 | 1108 | 44 | 1107 | 45 | 1106 | 46 | 1105 | 47 | 1104 | 48 | 1103 | 49 | 1102 | 50 | 1101 |
| 100-119 | 51 | 1100 | 52 | 1099 | 53 | 1098 | 54 | 1097 | 55 | 1096 | 56 | 1095 | 57 | 1094 | 58 | 1093 | 59 | 1092 | 60 | 1091 |
| 120-139 | 61 | 1090 | 62 | 1089 | 63 | 1088 | 64 | 1087 | 65 | 1086 | 66 | 1085 | 67 | 1084 | 68 | 1083 | 69 | 1082 | 70 | 1081 |
| 140-159 | 71 | 1080 | 72 | 1079 | 73 | 1078 | 74 | 1077 | 75 | 1076 | 76 | 1075 | 77 | 1074 | 78 | 1073 | 79 | 1072 | 80 | 1071 |
| 160-179 | 81 | 1070 | 82 | 1069 | 83 | 1068 | 84 | 1067 | 85 | 1066 | 86 | 1065 | 87 | 1064 | 88 | 1063 | 89 | 1062 | 90 | 1061 |
| 180-199 | 91 | 1060 | 92 | 1059 | 93 | 1058 | 94 | 1057 | 95 | 1056 | 96 | 1055 | 97 | 1054 | 98 | 1053 | 99 | 1052 | 100 | 1051 |
| 200-219 | 101 | 1050 | 102 | 1049 | 103 | 1048 | 104 | 1047 | 105 | 1046 | 106 | 1045 | 107 | 1044 | 108 | 1043 | 109 | 1042 | 110 | 1041 |
| 220-239 | 111 | 1040 | 112 | 1039 | 113 | 1038 | 114 | 1037 | 115 | 1036 | 116 | 1035 | 117 | 1034 | 118 | 1033 | 119 | 1032 | 120 | 1031 |
| 240-259 | 121 | 1030 | 122 | 1029 | 123 | 1028 | 124 | 1027 | 125 | 1026 | 126 | 1025 | 127 | 1024 | 128 | 1023 | 129 | 1022 | 130 | 1021 |
| 260-279 | 131 | 1020 | 132 | 1019 | 133 | 1018 | 134 | 1017 | 135 | 1016 | 136 | 1015 | 137 | 1014 | 138 | 1013 | 139 | 1012 | 140 | 1011 |
| 280-299 | 141 | 1010 | 142 | 1009 | 143 | 1008 | 144 | 1007 | 145 | 1006 | 146 | 1005 | 147 | 1004 | 148 | 1003 | 149 | 1002 | 150 | 1001 |
| 300-319 | 151 | 1000 | 152 | 999 | 153 | 998 | 154 | 997 | 155 | 996 | 156 | 995 | 157 | 994 | 158 | 993 | 159 | 992 | 160 | 991 |
| 320-339 | 161 | 990 | 162 | 989 | 163 | 988 | 164 | 987 | 165 | 986 | 166 | 985 | 167 | 984 | 168 | 983 | 169 | 982 | 170 | 981 |
| 340-359 | 171 | 980 | 172 | 979 | 173 | 978 | 174 | 977 | 175 | 976 | 176 | 975 | 177 | 974 | 178 | 973 | 179 | 972 | 180 | 971 |
| 360-379 | 181 | 970 | 182 | 969 | 183 | 968 | 184 | 967 | 185 | 966 | 186 | 965 | 187 | 964 | 188 | 963 | 189 | 962 | 190 | 961 |
| 380-399 | 191 | 960 | 192 | 959 | 193 | 958 | 194 | 957 | 195 | 956 | 196 | 955 | 197 | 954 | 198 | 953 | 199 | 952 | 200 | 951 |
| 400-419 | 201 | 950 | 202 | 949 | 203 | 948 | 204 | 947 | 205 | 946 | 206 | 945 | 207 | 944 | 208 | 943 | 209 | 942 | 210 | 941 |
| 420-439 | 211 | 940 | 212 | 939 | 213 | 938 | 214 | 937 | 215 | 936 | 216 | 935 | 217 | 934 | 218 | 933 | 219 | 932 | 220 | 931 |
| 440-459 | 221 | 930 | 222 | 929 | 223 | 928 | 224 | 927 | 225 | 926 | 226 | 925 | 227 | 924 | 228 | 923 | 229 | 922 | 230 | 921 |
| 460-479 | 231 | 920 | 232 | 919 | 233 | 918 | 234 | 917 | 235 | 916 | 236 | 915 | 237 | 914 | 238 | 913 | 239 | 912 | 240 | 911 |
| 480-499 | 241 | 910 | 242 | 909 | 243 | 908 | 244 | 907 | 245 | 906 | 246 | 905 | 247 | 904 | 248 | 903 | 249 | 902 | 250 | 901 |
| 500-519 | 251 | 900 | 252 | 899 | 253 | 898 | 254 | 897 | 255 | 896 | 256 | 895 | 257 | 894 | 258 | 893 | 259 | 892 | 260 | 891 |
| 520-539 | 261 | 890 | 262 | 889 | 263 | 888 | 264 | 887 | 265 | 886 | 266 | 885 | 267 | 884 | 268 | 883 | 269 | 882 | 270 | 881 |
| 540-559 | 271 | 880 | 272 | 879 | 273 | 878 | 274 | 877 | 275 | 876 | 276 | 875 | 277 | 874 | 278 | 873 | 279 | 872 | 280 | 871 |
| 560-579 | 281 | 870 | 282 | 869 | 283 | 868 | 284 | 867 | 285 | 866 | 286 | 865 | 287 | 864 | 288 | 863 | 289 | 862 | 290 | 861 |
| 580-599 | 291 | 860 | 292 | 859 | 293 | 858 | 294 | 857 | 295 | 856 | 296 | 855 | 297 | 854 | 298 | 853 | 299 | 852 | 300 | 851 |
| 600-619 | 301 | 850 | 302 | 849 | 303 | 848 | 304 | 847 | 305 | 846 | 306 | 845 | 307 | 844 | 308 | 843 | 309 | 842 | 310 | 841 |
| 620-639 | 311 | 840 | 312 | 839 | 313 | 838 | 314 | 837 | 315 | 836 | 316 | 835 | 317 | 834 | 318 | 833 | 319 | 832 | 320 | 831 |
| 640-659 | 321 | 830 | 322 | 829 | 323 | 828 | 324 | 827 | 325 | 826 | 326 | 825 | 327 | 824 | 328 | 823 | 329 | 822 | 330 | 821 |
| 660-679 | 331 | 820 | 332 | 819 | 333 | 818 | 334 | 817 | 335 | 816 | 336 | 815 | 337 | 814 | 338 | 813 | 339 | 812 | 340 | 811 |
| 680-699 | 341 | 810 | 342 | 809 | 343 | 808 | 344 | 807 | 345 | 806 | 346 | 805 | 347 | 804 | 348 | 803 | 349 | 802 | 350 | 801 |
| 700-719 | 351 | 800 | 352 | 799 | 353 | 798 | 354 | 797 | 355 | 796 | 356 | 795 | 357 | 794 | 358 | 793 | 359 | 792 | 360 | 791 |
| 720-739 | 361 | 790 | 362 | 789 | 363 | 788 | 364 | 787 | 365 | 786 | 366 | 785 | 367 | 784 | 368 | 783 | 369 | 782 | 370 | 781 |
| 740-759 | 371 | 780 | 372 | 779 | 373 | 778 | 374 | 777 | 375 | 776 | 376 | 775 | 377 | 774 | 378 | 773 | 379 | 772 | 380 | 771 |
| 760-779 | 381 | 770 | 382 | 769 | 383 | 768 | 384 | 767 | 385 | 766 | 386 | 765 | 387 | 764 | 388 | 763 | 389 | 762 | 390 | 761 |
| 780-799 | 391 | 760 | 392 | 759 | 393 | 758 | 394 | 757 | 395 | 756 | 396 | 755 | 397 | 754 | 398 | 753 | 399 | 752 | 400 | 751 |
| 800-819 | 401 | 750 | 402 | 749 | 403 | 748 | 404 | 747 | 405 | 746 | 406 | 745 | 407 | 744 | 408 | 743 | 409 | 742 | 410 | 741 |
| 820-839 | 411 | 740 | 412 | 739 | 413 | 738 | 414 | 737 | 415 | 736 | 416 | 735 | 417 | 734 | 418 | 733 | 419 | 732 | 420 | 731 |
| 840-859 | 421 | 730 | 422 | 729 | 423 | 728 | 424 | 727 | 425 | 726 | 426 | 725 | 427 | 724 | 428 | 723 | 429 | 722 | 430 | 721 |
| 860-879 | 431 | 720 | 432 | 719 | 433 | 718 | 434 | 717 | 435 | 716 | 436 | 715 | 437 | 714 | 438 | 713 | 439 | 712 | 440 | 711 |
| 880-899 | 441 | 710 | 442 | 709 | 443 | 708 | 444 | 707 | 445 | 706 | 446 | 705 | 447 | 704 | 448 | 703 | 449 | 702 | 450 | 701 |
| 900-919 | 451 | 700 | 452 | 699 | 453 | 698 | 454 | 697 | 455 | 696 | 456 | 695 | 457 | 694 | 458 | 693 | 459 | 692 | 460 | 691 |
| 920-939 | 461 | 690 | 462 | 689 | 463 | 688 | 464 | 687 | 465 | 686 | 466 | 685 | 467 | 684 | 468 | 683 | 469 | 682 | 470 | 681 |
| 940-959 | 471 | 680 | 472 | 679 | 473 | 678 | 474 | 677 | 475 | 676 | 476 | 675 | 477 | 674 | 478 | 673 | 479 | 672 | 480 | 671 |
| 960-979 | 481 | 670 | 482 | 669 | 483 | 668 | 484 | 667 | 485 | 666 | 486 | 665 | 487 | 664 | 488 | 663 | 489 | 662 | 490 | 661 |
| 980-999 | 491 | 660 | 492 | 659 | 493 | 658 | 494 | 657 | 495 | 656 | 496 | 655 | 497 | 654 | 498 | 653 | 499 | 652 | 500 | 651 |
| 1000-1019 | 501 | 650 | 502 | 649 | 503 | 648 | 504 | 647 | 505 | 646 | 506 | 645 | 507 | 644 | 508 | 643 | 509 | 642 | 510 | 641 |
| 1020-1039 | 511 | 640 | 512 | 639 | 513 | 638 | 514 | 637 | 515 | 636 | 516 | 635 | 517 | 634 | 518 | 633 | 519 | 632 | 520 | 631 |
| 1040-1059 | 521 | 630 | 522 | 629 | 523 | 628 | 524 | 627 | 525 | 626 | 526 | 625 | 527 | 624 | 528 | 623 | 529 | 622 | 530 | 621 |
| 1060-1079 | 531 | 620 | 532 | 619 | 533 | 618 | 534 | 617 | 535 | 616 | 536 | 615 | 537 | 614 | 538 | 613 | 539 | 612 | 540 | 611 |
| 1080-1099 | 541 | 610 | 542 | 609 | 543 | 608 | 544 | 607 | 545 | 606 | 546 | 605 | 547 | 604 | 548 | 603 | 549 | 602 | 550 | 601 |
| 1100-1119 | 551 | 600 | 552 | 599 | 553 | 598 | 554 | 597 | 555 | 596 | 556 | 595 | 557 | 594 | 558 | 593 | 559 | 592 | 560 | 591 |
| 1120-1139 | 561 | 590 | 562 | 589 | 563 | 588 | 564 | 587 | 565 | 586 | 566 | 585 | 567 | 584 | 568 | 583 | 569 | 582 | 570 | 581 |
| 1140-1149 | 571 | 580 | 572 | 579 | 573 | 578 | 574 | 577 | 575 | 576 | - | - | - | - | - | - | - | - | - | - |

Table 6.3.3.1-4B: Mapping from *logical index* to sequence number for preamble formats with .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sequence number in increasing order of | | | | | | | | | | | | | | | | | | | |
| 0-19 | 1 | 570 | 2 | 569 | 3 | 568 | 4 | 567 | 5 | 566 | 6 | 565 | 7 | 564 | 8 | 563 | 9 | 562 | 10 | 561 |
| 20-39 | 11 | 560 | 12 | 559 | 13 | 558 | 14 | 557 | 15 | 556 | 16 | 555 | 17 | 554 | 18 | 553 | 19 | 552 | 20 | 551 |
| 40-59 | 21 | 550 | 22 | 549 | 23 | 548 | 24 | 547 | 25 | 546 | 26 | 545 | 27 | 544 | 28 | 543 | 29 | 542 | 30 | 541 |
| 60-79 | 31 | 540 | 32 | 539 | 33 | 538 | 34 | 537 | 35 | 536 | 36 | 535 | 37 | 534 | 38 | 533 | 39 | 532 | 40 | 531 |
| 80-99 | 41 | 530 | 42 | 529 | 43 | 528 | 44 | 527 | 45 | 526 | 46 | 525 | 47 | 524 | 48 | 523 | 49 | 522 | 50 | 521 |
| 100-119 | 51 | 520 | 52 | 519 | 53 | 518 | 54 | 517 | 55 | 516 | 56 | 515 | 57 | 514 | 58 | 513 | 59 | 512 | 60 | 511 |
| 120-139 | 61 | 510 | 62 | 509 | 63 | 508 | 64 | 507 | 65 | 506 | 66 | 505 | 67 | 504 | 68 | 503 | 69 | 502 | 70 | 501 |
| 140-159 | 71 | 500 | 72 | 499 | 73 | 498 | 74 | 497 | 75 | 496 | 76 | 495 | 77 | 494 | 78 | 493 | 79 | 492 | 80 | 491 |
| 160-179 | 81 | 490 | 82 | 489 | 83 | 488 | 84 | 487 | 85 | 486 | 86 | 485 | 87 | 484 | 88 | 483 | 89 | 482 | 90 | 481 |
| 180-199 | 91 | 480 | 92 | 479 | 93 | 478 | 94 | 477 | 95 | 476 | 96 | 475 | 97 | 474 | 98 | 473 | 99 | 472 | 100 | 471 |
| 200-219 | 101 | 470 | 102 | 469 | 103 | 468 | 104 | 467 | 105 | 466 | 106 | 465 | 107 | 464 | 108 | 463 | 109 | 462 | 110 | 461 |
| 220-239 | 111 | 460 | 112 | 459 | 113 | 458 | 114 | 457 | 115 | 456 | 116 | 455 | 117 | 454 | 118 | 453 | 119 | 452 | 120 | 451 |
| 240-259 | 121 | 450 | 122 | 449 | 123 | 448 | 124 | 447 | 125 | 446 | 126 | 445 | 127 | 444 | 128 | 443 | 129 | 442 | 130 | 441 |
| 260-279 | 131 | 440 | 132 | 439 | 133 | 438 | 134 | 437 | 135 | 436 | 136 | 435 | 137 | 434 | 138 | 433 | 139 | 432 | 140 | 431 |
| 280-299 | 141 | 430 | 142 | 429 | 143 | 428 | 144 | 427 | 145 | 426 | 146 | 425 | 147 | 424 | 148 | 423 | 149 | 422 | 150 | 421 |
| 300-319 | 151 | 420 | 152 | 419 | 153 | 418 | 154 | 417 | 155 | 416 | 156 | 415 | 157 | 414 | 158 | 413 | 159 | 412 | 160 | 411 |
| 320-339 | 161 | 410 | 162 | 409 | 163 | 408 | 164 | 407 | 165 | 406 | 166 | 405 | 167 | 404 | 168 | 403 | 169 | 402 | 170 | 401 |
| 340-359 | 171 | 400 | 172 | 399 | 173 | 398 | 174 | 397 | 175 | 396 | 176 | 395 | 177 | 394 | 178 | 393 | 179 | 392 | 180 | 391 |
| 360-379 | 181 | 390 | 182 | 389 | 183 | 388 | 184 | 387 | 185 | 386 | 186 | 385 | 187 | 384 | 188 | 383 | 189 | 382 | 190 | 381 |
| 380-399 | 191 | 380 | 192 | 379 | 193 | 378 | 194 | 377 | 195 | 376 | 196 | 375 | 197 | 374 | 198 | 373 | 199 | 372 | 200 | 371 |
| 400-419 | 201 | 370 | 202 | 369 | 203 | 368 | 204 | 367 | 205 | 366 | 206 | 365 | 207 | 364 | 208 | 363 | 209 | 362 | 210 | 361 |
| 420-439 | 211 | 360 | 212 | 359 | 213 | 358 | 214 | 357 | 215 | 356 | 216 | 355 | 217 | 354 | 218 | 353 | 219 | 352 | 220 | 351 |
| 440-459 | 221 | 350 | 222 | 349 | 223 | 348 | 224 | 347 | 225 | 346 | 226 | 345 | 227 | 344 | 228 | 343 | 229 | 342 | 230 | 341 |
| 460-479 | 231 | 340 | 232 | 339 | 233 | 338 | 234 | 337 | 235 | 336 | 236 | 335 | 237 | 334 | 238 | 333 | 239 | 332 | 240 | 331 |
| 480-499 | 241 | 330 | 242 | 329 | 243 | 328 | 244 | 327 | 245 | 326 | 246 | 325 | 247 | 324 | 248 | 323 | 249 | 322 | 250 | 321 |
| 500-519 | 251 | 320 | 252 | 319 | 253 | 318 | 254 | 317 | 255 | 316 | 256 | 315 | 257 | 314 | 258 | 313 | 259 | 312 | 260 | 311 |
| 520-539 | 261 | 310 | 262 | 309 | 263 | 308 | 264 | 307 | 265 | 306 | 266 | 305 | 267 | 304 | 268 | 303 | 269 | 302 | 270 | 301 |
| 540-559 | 271 | 300 | 272 | 299 | 273 | 298 | 274 | 297 | 275 | 296 | 276 | 295 | 277 | 294 | 278 | 293 | 279 | 292 | 280 | 291 |
| 560-569 | 281 | 290 | 282 | 289 | 283 | 288 | 284 | 287 | 285 | 286 | - | - | - | - | - | - | - | - | - | - |

Table 6.3.3.1-5:  for preamble formats with kHz.

|  |  |  |  |
| --- | --- | --- | --- |
| *zeroCorrelationZoneConfig*, *msgA-ZeroCorrelationZoneConfig* | value | | |
| Unrestricted set | Restricted set type A | Restricted set type B |
| 0 | 0 | 15 | 15 |
| 1 | 13 | 18 | 18 |
| 2 | 15 | 22 | 22 |
| 3 | 18 | 26 | 26 |
| 4 | 22 | 32 | 32 |
| 5 | 26 | 38 | 38 |
| 6 | 32 | 46 | 46 |
| 7 | 38 | 55 | 55 |
| 8 | 46 | 68 | 68 |
| 9 | 59 | 82 | 82 |
| 10 | 76 | 100 | 100 |
| 11 | 93 | 128 | 118 |
| 12 | 119 | 158 | 137 |
| 13 | 167 | 202 | - |
| 14 | 279 | 237 | - |
| 15 | 419 | - | - |

Table 6.3.3.1-6:  for preamble formats with kHz.

|  |  |  |  |
| --- | --- | --- | --- |
| *zeroCorrelationZoneConfig*, *msgA-ZeroCorrelationZoneConfig* | value | | |
| Unrestricted set | Restricted set type A | Restricted set type B |
| 0 | 0 | 36 | 36 |
| 1 | 13 | 57 | 57 |
| 2 | 26 | 72 | 60 |
| 3 | 33 | 81 | 63 |
| 4 | 38 | 89 | 65 |
| 5 | 41 | 94 | 68 |
| 6 | 49 | 103 | 71 |
| 7 | 55 | 112 | 77 |
| 8 | 64 | 121 | 81 |
| 9 | 76 | 132 | 85 |
| 10 | 93 | 137 | 97 |
| 11 | 119 | 152 | 109 |
| 12 | 139 | 173 | 122 |
| 13 | 209 | 195 | 137 |
| 14 | 279 | 216 | - |
| 15 | 419 | 237 | - |

Table 6.3.3.1-7:  for preamble formats with .

|  |  |  |  |
| --- | --- | --- | --- |
| *zeroCorrelationZoneConfig*, *msgA-ZeroCorrelationZoneConfig* | value | | |
|  |  |  |  |
| 0 | 0 | 0 | 0 |
| 1 | 2 | 8 | 17 |
| 2 | 4 | 10 | 21 |
| 3 | 6 | 12 | 25 |
| 4 | 8 | 15 | 30 |
| 5 | 10 | 17 | 35 |
| 6 | 12 | 21 | 44 |
| 7 | 13 | 25 | 52 |
| 8 | 15 | 31 | 63 |
| 9 | 17 | 40 | 82 |
| 10 | 19 | 51 | 104 |
| 11 | 23 | 63 | 127 |
| 12 | 27 | 81 | 164 |
| 13 | 34 | 114 | 230 |
| 14 | 46 | 190 | 383 |
| 15 | 69 | 285 | 575 |

##### 6.4.1.1.3 Precoding and mapping to physical resources

The sequence  shall be mapped to the intermediate quantity according to

- if transform precoding is not enabled,

- if the higher-layer parameter *dmrs-TypeEnh* is configured

- otherwise

- if transform precoding is enabled

where , , and are given by Tables 6.4.1.1.3-1 and 6.4.1.1.3-2 and the configuration type is given by the higher-layer parameter *DMRS-UplinkConfig*, and both and correspond to . The intermediate quantity if Δ corresponds to any other antenna ports than*.*

The intermediate quantity shall be precoded, multiplied with the amplitude scaling factor in order to conform to the transmit power specified in [6, TS 38.214], and mapped to physical resources according to

where

- the precoding matrix is given by clause 6.3.1.5,

- the set of antenna ports is given by clause 6.3.1.5, and

- the set of antenna ports is given by [6, TS 38.214];

and the following conditions are fulfilled:

- the resource elements are within the common resource blocks allocated for PUSCH transmission.

The reference point for is

- subcarrier 0 in common resource block 0 if transform precoding is not enabled, and

- subcarrier 0 of the lowest-numbered resource block of the scheduled PUSCH allocation if transform precoding is enabled.

The reference point for and the position  of the first DM-RS symbol depends on the mapping type:

- for PUSCH mapping type A:

-  is defined relative to the start of the slot if frequency hopping is disabled and relative to the start of each hop in case frequency hopping is enabled

-  is given by the higher-layer parameter *dmrs-TypeA-Position*

- for PUSCH mapping type B:

-  is defined relative to the start of the scheduled PUSCH resources if frequency hopping is disabled and relative to the start of each hop in case frequency hopping is enabled

- 

The position(s) of the DM-RS symbols is given by  and duration where

- is the duration between the first OFDM symbol of the slot and the last OFDM symbol of the scheduled PUSCH resources in the slot for PUSCH mapping type A according to Tables 6.4.1.1.3-3 and 6.4.1.1.3-4 if intra-slot frequency hopping is not used, or

- is the duration of scheduled PUSCH resources for PUSCH mapping type B according to Tables 6.4.1.1.3-3 and 6.4.1.1.3-4 if intra-slot frequency hopping is not used, or

- is the duration per hop according to Table 6.4.1.1.3-6 if intra-slot frequency hopping is used.

- if the higher-layer parameter *maxLength* in *DMRS-UplinkConfig* is not configured, or for a msgA transmission *msgA-MaxLength* in *msgA-DMRS-Config* is not configured, the tables shall be used according to single-symbol DM-RS

- if the higher-layer parameter *maxLength* in *DMRS-UplinkConfig* is equal to 'len2', the associated DCI or configured grant configuration determines whether single-symbol or double-symbol DM-RS shall be used

- if the higher-layer parameter *msgA-MaxLength* in *msgA-DMRS-Config* is equal to 'len2', double-symbol DM-RS shall be used

- if the higher-layer parameter *dmrs-AdditionalPosition* is not set to 'pos0' and intra-slot frequency hopping is enabled according to clause 7.3.1.1.2 in [4, TS 38.212] and by higher layer, Tables 6.4.1.1.3-6 shall be used assuming *dmrs-AdditionalPosition* is equal to 'pos1' for each hop.

For PUSCH mapping type A,

- the case *dmrs-AdditionalPosition* is equal to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2';

- symbols in Table 6.4.1.1.3-4 is only applicable when *dmrs-TypeA-Position* is equal to 'pos2'.

For msgA transmitted using PUSCH mapping type A,

- the case *msgA-DMRS-AdditionalPosition* is equal to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2';

- *'dmrs-AdditionalPosition*' in Tables 6.4.1.1.3-3 to 6.4.1.1.3-6 shall be replaced by *msgA-DMRS-AdditionalPosition;*

- only PUSCH DM-RS configuration type 1 is supported;

- only basic DM-RS multiplexing in Table 6.4.1.1.3-5 is supported.

For msgA transmitted using PUSCH mapping type B,

- '*dmrs-AdditionalPosition*' in Tables 6.4.1.1.3-3 to 6.4.1.1.3-6 shall be replaced by *msgA-DMRS-AdditionalPosition*;

- only PUSCH DM-RS configuration type 1 is supported;

- only basic DM-RS multiplexing in Table 6.4.1.1.3-5 is supported.

The time-domain index , and the supported antenna ports are given by Table 6.4.1.1.3-5.

Table 6.4.1.1.3-1: Parameters for PUSCH DM-RS configuration type 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **CDM group** |  |  |  |
| 0 | 0 | 0 |  |  |
| 1 | 0 | 0 |  |  |
| 2 | 1 | 1 |  |  |
| 3 | 1 | 1 |  |  |
| 4 | 0 | 0 |  |  |
| 5 | 0 | 0 |  |  |
| 6 | 1 | 1 |  |  |
| 7 | 1 | 1 |  |  |
| 8 | 0 | 0 |  |  |
| 9 | 0 | 0 |  |  |
| 10 | 1 | 1 |  |  |
| 11 | 1 | 1 |  |  |
| 12 | 0 | 0 |  |  |
| 13 | 0 | 0 |  |  |
| 14 | 1 | 1 |  |  |
| 15 | 1 | 1 |  |  |

Table 6.4.1.1.3-2: Parameters for PUSCH DM-RS configuration type 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **CDM group** |  |  |  |
| 0 | 0 | 0 |  |  |
| 1 | 0 | 0 |  |  |
| 2 | 1 | 2 |  |  |
| 3 | 1 | 2 |  |  |
| 4 | 2 | 4 |  |  |
| 5 | 2 | 4 |  |  |
| 6 | 0 | 0 |  |  |
| 7 | 0 | 0 |  |  |
| 8 | 1 | 2 |  |  |
| 9 | 1 | 2 |  |  |
| 10 | 2 | 4 |  |  |
| 11 | 2 | 4 |  |  |
| 12 | 0 | 0 |  |  |
| 13 | 0 | 0 |  |  |
| 14 | 1 | 2 |  |  |
| 15 | 1 | 2 |  |  |
| 16 | 2 | 4 |  |  |
| 17 | 2 | 4 |  |  |
| 18 | 0 | 0 |  |  |
| 19 | 0 | 0 |  |  |
| 20 | 1 | 2 |  |  |
| 21 | 1 | 2 |  |  |
| 22 | 2 | 4 |  |  |
| 23 | 2 | 4 |  |  |

Table 6.4.1.1.3-3: PUSCH DM-RS positions  within a slot for single-symbol DM-RS and intra-slot frequency hopping disabled.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| in symbols | DM-RS positions | | | | | | | |
| PUSCH mapping type A | | | | PUSCH mapping type B | | | |
| *dmrs-AdditionalPosition* | | | | *dmrs-AdditionalPosition* | | | |
| *pos0* | *pos1* | *pos2* | *pos3* | *pos0* | *pos1* | *pos2* | *pos3* |
| <4 | - | - | - | - |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  | , 4 | , 4 | , 4 |
| 6 |  |  |  |  |  | , 4 | , 4 | , 4 |
| 7 |  |  |  |  |  | , 4 | , 4 | , 4 |
| 8 |  | , 7 | , 7 | , 7 |  | , 6 | , 3, 6 | , 3, 6 |
| 9 |  | , 7 | , 7 | , 7 |  | , 6 | , 3, 6 | , 3, 6 |
| 10 |  | , 9 | , 6, 9 | , 6, 9 |  | , 8 | , 4, 8 | , 3, 6, 9 |
| 11 |  | , 9 | , 6, 9 | , 6, 9 |  | , 8 | , 4, 8 | , 3, 6, 9 |
| 12 |  | , 9 | , 6, 9 | , 5, 8, 11 |  | , 10 | , 5, 10 | , 3, 6, 9 |
| 13 |  | , 11 | , 7, 11 | , 5, 8, 11 |  | , 10 | , 5, 10 | , 3, 6, 9 |
| 14 |  | , 11 | , 7, 11 | , 5, 8, 11 |  | , 10 | , 5, 10 | , 3, 6, 9 |

Table 6.4.1.1.3-4: PUSCH DM-RS positions  within a slot for double-symbol DM-RS and intra-slot frequency hopping disabled.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **in symbols** | **DM-RS positions** | | | | | | | |
| **PUSCH mapping type A** | | | | **PUSCH mapping type B** | | | |
| ***dmrs-AdditionalPosition*** | | | | ***dmrs-AdditionalPosition*** | | | |
| ***pos0*** | ***pos1*** | ***pos2*** | ***pos3*** | ***pos0*** | ***pos1*** | ***pos2*** | ***pos3*** |
| <4 | - | - |  |  | - | - |  |  |
| 4 |  |  |  |  | - | - |  |  |
| 5 |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  | , 5 |  |  |
| 9 |  |  |  |  |  | , 5 |  |  |
| 10 |  | , 8 |  |  |  | , 7 |  |  |
| 11 |  | , 8 |  |  |  | , 7 |  |  |
| 12 |  | , 8 |  |  |  | , 9 |  |  |
| 13 |  | , 10 |  |  |  | , 9 |  |  |
| 14 |  | , 10 |  |  |  | , 9 |  |  |

Table 6.4.1.1.3-5: PUSCH DM-RS time index .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DM-RS multiplexing** | **DM-RS duration** |  | **Supported antenna ports** | |
| **Configuration type 1** | **Configuration type 2** |
| Basic | single-symbol DM-RS | 0 | 0 – 3 | 0 – 5 |
| double-symbol DM-RS | 0, 1 | 0 – 7 | 0 – 11 |
| Enhanced | single-symbol DM-RS | 0 | 0 – 3, 8 – 11 | 0 – 5, 12 – 17 |
| double-symbol DM-RS | 0, 1 | 0 – 15 | 0 – 23 |

Table 6.4.1.1.3-6: PUSCH DM-RS positions  within a slot for single-symbol DM-RS and intra-slot frequency hopping enabled.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **in symbols** | **DM-RS positions** | | | | | | | | | | | |
| **PUSCH mapping type A** | | | | | | | | **PUSCH mapping type B** | | | |
|  | | | |  | | | |
| ***dmrs-AdditionalPosition*** | | | | ***dmrs-AdditionalPosition*** | | | | ***dmrs-AdditionalPosition*** | | | |
| ***pos0*** | | ***pos1*** | | ***pos0*** | | ***pos1*** | | ***pos0*** | | ***pos1*** | |
| **1st hop** | **2nd hop** | **1st hop** | **2nd hop** | **1st hop** | **2nd hop** | **1st hop** | **2nd hop** | **1st hop** | **2nd hop** | **1st hop** | **2nd hop** |
| ≤3 | - | - | - | - | - | - | - | - | 0 | 0 |  | 0 |
| 4 | 2 | 0 | 2 | 0 | 3 | 0 | 3 | 0 | 0 | 0 |  | 0 |
| 5, 6 | 2 | 0 | 2 | 0, 4 | 3 | 0 | 3 | 0, 4 | 0 | 0 |  | 0, 4 |
| 7 | 2 | 0 | 2, 6 | 0, 4 | 3 | 0 | 3 | 0, 4 | 0 | 0 |  | 0, 4 |

##### 7.4.1.1.2 Mapping to physical resources

The UE shall assume the PDSCH DM-RS being mapped to physical resources according to configuration type 1 or configuration type 2 as given by the higher-layer parameter *dmrs-Type*.

The UE shall assume the sequence  is scaled by a factor to conform with the transmission power specified in [6, TS 38.214] and mapped to resource elements according to

- if the higher-layer parameter *dmrs-TypeEnh* is configured and the PDSCH is not scheduled by DCI format 1\_0, 4\_0, or 4\_1

- otherwise

where , , and are given by Tables 7.4.1.1.2-1 and 7.4.1.1.2-2 and the following conditions are fulfilled:

- the resource elements are within the common resource blocks allocated for PDSCH transmission

The reference point for is

- subcarrier 0 of the lowest-numbered resource block in CORESET 0 if the corresponding PDCCH is associated with CORESET 0 and Type0-PDCCH common search space and is addressed to SI-RNTI;

- otherwise, subcarrier 0 in common resource block 0

The reference point for  and the position  of the first DM-RS symbol depends on the mapping type:

- for PDSCH mapping type A:

-  is defined relative to the start of the slot

- if the higher-layer parameter *dmrs-TypeA-Position* is equal to 'pos3' and  otherwise

- for PDSCH mapping type B:

-  is defined relative to the start of the scheduled PDSCH resources

- 

The position(s) of the DM-RS symbols is given by  and duration where

- for PDSCH mapping type A, is the duration between the first OFDM symbol of the slot and the last OFDM symbol of the scheduled PDSCH resources in the slot

- for PDSCH mapping type B, is the duration of the scheduled PDSCH resources

and according to Tables 7.4.1.1.2-3 and 7.4.1.1.2-4.

For PDSCH mapping type A

- the case *dmrs-AdditionalPosition* equals to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2';

- and symbols in Tables 7.4.1.1.2-3 and 7.4.1.1.2-4 respectively is only applicable when *dmrs-TypeA-Position* is equal to 'pos2';

- single-symbol DM-RS, except if all of the following conditions are fulfilled in which case :

- the higher-layer parameter *lte-CRS-ToMatchAround*, *lte-CRS-PatternList1*, *lte-CRS-PatternList2*, *lte-CRS-PatternList3*, or *lte-CRS-PatternList4* is configured; and

*-* the higher-layer parameter *dmrs-AdditionalPosition* is equal to 'pos1' and ; and

*-* the UE has indicated it is capable of *additionalDMRS-DL-Alt*

For PDSCH mapping type B

- if the PDSCH duration  OFDM symbols for normal cyclic prefix or OFDM symbols for extended cyclic prefix, and the front-loaded DM-RS of the PDSCH allocation collides with resources reserved for a search space set associated with a CORESET,  shall be incremented such that the first DM-RS symbol occurs immediately after the CORESET and until no collision with any CORESET occurs, and

- if the PDSCH duration is 2 symbols, the UE is not expected to receive a DM-RS symbol beyond the second symbol;

- if the PDSCH duration is 5 symbols and if one additional single-symbol DMRS is configured, the UE only expects the additional DM-RS to be transmitted on the 5th symbol when the front-loaded DM-RS symbol is in the 1st symbol of the PDSCH duration, otherwise the UE should expect that the additional DM-RS is not transmitted;

- if the PDSCH duration is 7 symbols for normal cyclic prefix or 6 symbols for extended cyclic prefix:

- if one additional single-symbol DM-RS is configured, the UE only expects the additional DM-RS to be transmitted on the 5th or 6th symbol when the front-loaded DM-RS symbol is in the 1st or 2nd symbol, respectively, of the PDSCH duration, otherwise the UE should expect that the additional DM-RS is not transmitted;

- if the PDSCH duration OFDM symbols, the UE is not expected to receive the front-loaded DM-RS beyond the 4th symbol;

- if the PDSCH duration is 12 or 13 symbols, the UE is not expected to receive DM-RS mapped to symbol 12 or later in the slot;

- for all values of the PDSCH duration other than 2, 5, and 7 symbols, the UE is not expected to receive DM-RS beyond the :th symbol;

- if the PDSCH duration is less than or equal to 4 OFDM symbols, only single-symbol DM-RS is supported.

- if the higher-layer parameter *lte-CRS-ToMatchAround*, *lte-CRS-PatternList1*, *lte-CRS-PatternList2*, *lte-CRS-PatternList3*, or *lte-CRS-PatternList4* is configured, the PDSCH duration symbols for normal cyclic prefix, the subcarrier spacing configuration , single-symbol DM-RS is configured, and at least one PDSCH DM-RS symbol in the PDSCH allocation collides with a symbol containing resource elements as indicated by the higher-layer parameter *lte-CRS-ToMatchAround*, *lte-CRS-PatternList1*, *lte-CRS-PatternList2*, *lte-CRS-PatternList3*, or *lte-CRS-PatternList4*, then shall be incremented by one in all slots.

The time-domain index and the supported antenna ports are given by Table 7.4.1.1.2-5 where

- single-symbol DM-RS is used if the higher-layer parameter *maxLength* in the *DMRS-DownlinkConfig* IE is not configured;

- single-symbol or double-symbol DM-RS is determined by the associated DCI if the higher-layer parameter *maxLength* in the *DMRS-DownlinkConfig* IE is equal to 'len2';

- basic or enhanced DM-RS multiplexing is controlled by the higher-layer parameter *dmrs-TypeEnh.*

In absence of CSI-RS configuration, and unless otherwise configured, the UE may assume PDSCH DM-RS and SS/PBCH block to be quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and, when applicable, spatial Rx parameters. Unless specified otherwise, the UE may assume that the PDSCH DM-RS within the same CDM group are quasi co-located with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial Rx (when applicable). The UE may assume that DMRS ports associated with a TCI state as described in clause 5.1.6.2 of [6, TS 38.214] of a PDSCH are QCL with QCL Type A, Type D (when applicable) and average gain.

The UE may assume that no DM-RS collides with the SS/PBCH block.

Table 7.4.1.1.2-1: Parameters for PDSCH DM-RS configuration type 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **CDM group** |  |  |  |
| 1000 | 0 | 0 |  |  |
| 1001 | 0 | 0 |  |  |
| 1002 | 1 | 1 |  |  |
| 1003 | 1 | 1 |  |  |
| 1004 | 0 | 0 |  |  |
| 1005 | 0 | 0 |  |  |
| 1006 | 1 | 1 |  |  |
| 1007 | 1 | 1 |  |  |
| 1008 | 0 | 0 |  |  |
| 1009 | 0 | 0 |  |  |
| 1010 | 1 | 1 |  |  |
| 1011 | 1 | 1 |  |  |
| 1012 | 0 | 0 |  |  |
| 1013 | 0 | 0 |  |  |
| 1014 | 1 | 1 |  |  |
| 1015 | 1 | 1 |  |  |

Table 7.4.1.1.2-2: Parameters for PDSCH DM-RS configuration type 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **CDM group** |  |  |  |
| 1000 | 0 | 0 |  |  |
| 1001 | 0 | 0 |  |  |
| 1002 | 1 | 2 |  |  |
| 1003 | 1 | 2 |  |  |
| 1004 | 2 | 4 |  |  |
| 1005 | 2 | 4 |  |  |
| 1006 | 0 | 0 |  |  |
| 1007 | 0 | 0 |  |  |
| 1008 | 1 | 2 |  |  |
| 1009 | 1 | 2 |  |  |
| 1010 | 2 | 4 |  |  |
| 1011 | 2 | 4 |  |  |
| 1012 | 0 | 0 |  |  |
| 1013 | 0 | 0 |  |  |
| 1014 | 1 | 2 |  |  |
| 1015 | 1 | 2 |  |  |
| 1016 | 2 | 4 |  |  |
| 1017 | 2 | 4 |  |  |
| 1018 | 0 | 0 |  |  |
| 1019 | 0 | 0 |  |  |
| 1020 | 1 | 2 |  |  |
| 1021 | 1 | 2 |  |  |
| 1022 | 2 | 4 |  |  |
| 1023 | 2 | 4 |  |  |

Table 7.4.1.1.2-3: PDSCH DM-RS positions  for single-symbol DM-RS.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **in symbols** | **DM-RS positions** | | | | | | | |
| **PDSCH mapping type A** | | | | **PDSCH mapping type B** | | | |
| ***dmrs-AdditionalPosition*** | | | | ***dmrs-AdditionalPosition*** | | | |
| ***pos0*** | ***pos1*** | ***pos2*** | ***pos3*** | ***pos0*** | ***pos1*** | ***pos2*** | ***pos3*** |
| 2 | - | - | - | - |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |
| 8 |  | , 7 | , 7 | , 7 |  |  |  |  |
| 9 |  | , 7 | , 7 | , 7 |  |  |  |  |
| 10 |  | , 9 | , 6, 9 | , 6, 9 |  |  |  |  |
| 11 |  | , 9 | , 6, 9 | , 6, 9 |  |  |  |  |
| 12 |  | , 9 | , 6, 9 | , 5, 8, 11 |  |  |  |  |
| 13 |  | , | , 7, 11 | , 5, 8, 11 |  |  |  |  |
| 14 |  | , | , 7, 11 | , 5, 8, 11 | - | - | - | - |

Table 7.4.1.1.2-4: PDSCH DM-RS positions  for double-symbol DM-RS.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **in symbols** | **DM-RS positions** | | | | | |
| **PDSCH mapping type A** | | | **PDSCH mapping type B** | | |
| ***dmrs-AdditionalPosition*** | | | ***dmrs-AdditionalPosition*** | | |
| ***pos0*** | ***pos1*** | ***pos2*** | ***pos0*** | ***pos1*** | ***pos2*** |
| <4 |  |  |  | - | - |  |
| 4 |  |  |  | - | - |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 10 |  | , 8 |  |  |  |  |
| 11 |  | , 8 |  |  |  |  |
| 12 |  | , 8 |  |  |  |  |
| 13 |  | , 10 |  |  |  |  |
| 14 |  | , 10 |  | - | - |  |

Table 7.4.1.1.2-5: PDSCH DM-RS time index and antenna ports .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DM-RS multiplexing** | **DM-RS duration** |  | **Supported antenna ports** | |
| **Configuration type 1** | **Configuration type 2** |
| Basic | single-symbol DM-RS | 0 | 1000 – 1003 | 1000 – 1005 |
| double-symbol DM-RS | 0, 1 | 1000 – 1007 | 1000 – 1011 |
| Enhanced | single-symbol DM-RS | 0 | 1000 – 1003, 1008 – 1011 | 1000 – 1005, 1012 – 1017 |
| double-symbol DM-RS | 0, 1 | 1000 – 1015 | 1000 – 1023 |