**3GPP TSG- Meeting #**

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

|  |
| --- |
|  |
| ***Title:***  | Draft CR on PDSCH demodulation requirements for RedCap |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_redcap-Perf |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Based on the work plan R4-2210931 WF, RAN4 should submit the draft CR for RedCap for review. |
|  |  |
| ***Summary of change:*** | Introducing PDSCH performance requirements for RedCap for 1Rx and 2Rx |
|  |  |
| ***Consequences if not approved:*** | RedCap performance requirements will not be completed |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.521-4  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*-----------------Change 1---------------------*

##### 5.2.1.1.1 Minimum requirements for RedCap

The performance requirements are specified in Table 5.2.1.1.1-3, with the addition of test parameters in Table 5.2.1.1.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.1.1.1-1.

Table 5.2.1.1.1-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 1 receive antenna conditions and with different channel models and MCSs for RedCap | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.1.1.1-2: Test parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Duplex mode |  | FDD |
| Active DL BWP index |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S)  |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-12 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1,1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
| Number of HARQ Processes |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 2 |

Table 5.2.1.1.1-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x1 Low | 70 | [3.7] |
| 1-2 | R.PDSCH.1-2.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x1 Low | 70 | [12.2] |
| 1-3 | R.PDSCH.1-3.5 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x1 Low | 70 | [16.5] |
| 1-4 | R.PDSCH.1-4.2 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 256QAM, 0.67 | TDLA30-10 | 2x1 Low | 70 | TBA |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD.  |

*<Unchanged sections skipped>*

*-----------------Change 2---------------------*

##### 5.2.1.2.1 Minimum requirements for RedCap

The performance requirements are specified in Table 5.2.1.2.1-3, with the addition of test parameters in Table 5.2.1.2.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.1.2.1-1.

Table 5.2.1.2.1-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs for RedCap UEs | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.1.2.1-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S)  |  | 2 |
|  | Length (L) |  | Specific to each Reference channel |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-1,2 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1, 1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS  |  | Table 5.2-1 |
|  | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
|  | Frequency Occupation |  | Table 5.2-1 |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.1.2.1-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x1 Low | 70 | [3.8] |
| 1-2 | R.PDSCH.2-X.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x1 Low | 70 | [12.3] |
| 1-3 | R.PDSCH.2-3.5 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | [17.1] |
| 1-4 | R.PDSCH.2-4.3 TDD | 20 / 30 | 256QAM, 0.67 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | TBA |

*<Unchanged sections skipped>*

*-----------------Change 3---------------------*

##### 5.2.2.1.X Minimum requirements for RedCap

The performance requirements are specified in Table 5.2.2.1.X-3, with the addition of test parameters in Table 5.2.2.1.X-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.X-1.

Table 5.2.2.1.X-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs for RedCap | 1-1, 1-2, 1-3, 2-1 |

Table 5.2.2.1.X-2: Test parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Duplex mode |  | FDD |
| Active DL BWP index |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S)  |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-12 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-11 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
| Number of HARQ Processes |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 2 |

 Table 5.2.2.1.X-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x2, ULA Low | 70 | -0.8 |
| 1-2 | R.PDSCH.1-2.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | [8.1] |
| 1-3 | R.PDSCH.1-4.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x2, ULA Low | 70 | 24.6 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD.  |

Table 5.2.2.1.X-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDDR.PDSCH.X TBD HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 19.4 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD.  |

*<Unchanged sections skipped>*

*-----------------Change 4---------------------*

##### 5.2.2.2.X Minimum requirements for RedCap

The performance requirements are specified in Table 5.2.2.2.X-3 and Table 5.2.2.2.X-4, with the addition of test parameters in Table 5.2.2.2.X-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.X-1.

Table 5.2.2.2.X-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for RedCap UEs | 1-1, 1-2, 1-3, 2-1 |

Table 5.2.2.2.X-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S)  |  | 2 |
|  | Length (L) |  | Specific to each Reference channel |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-12 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-11 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS  |  | Table 5.2-1 |
|  | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
|  | Frequency Occupation |  | Table 5.2-1 |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.X-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x2, ULA Low | 70 | [0.2] |
| 1-2 | R.PDSCH.2-4.2 TDD | 20 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | [25.3] |
| 1-3 | R.PDSCH.2-X.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | [8.1] |

Table 5.2.2.2.X-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 2-1 | R.PDSCH.2-X1.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | [20.1] |

*<Unchanged sections skipped>*

*-----------------Change 5---------------------*

Table A.3.2.1.1-3: PDSCH Reference Channel for FDD (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.1-3.1 FDD | R.PDSCH.1-3.2 FDD | R.PDSCH.1-3.3 FDD | R.PDSCH.1-3.4 FDD | R.PDSCH.1-3.5 FDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 | 10 |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 | 15 |
| Number of allocated resource blocks | PRBs | 52 | 52 | 26 (Note 3) | 26 (Note 4) | 52 |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames | Slots | 19 | 19 | 19 | 19 | 19 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| MCS index |  | 19 | 19 | 19 | 19 | 19 |
| Modulation |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Target Coding Rate |  | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Number of MIMO layers |  | 2 | 2 | 2 | 2 | 1 |
| Number of DMRS REs |  | 12 | 24 | 24 | 24 | 12 |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 | 0 |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 1,…, 19 | Bits | 42016 | 37896 | 18960 | 18960 | 21000 |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 1,…, 19 | Bits | 24 | 24 | 24 | 24 | 24 |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 1,…, 19 | CBs | 5 | 5 | 3 | 3 | 3 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 10, 11 | Bits | 78624 | 67392 | 33696 | 33696 | 39312 |
|  For Slots i = 1,…, 9, 12, …, 19 | Bits | 82368 | 74880 | 37440 | 37440 | 41184 |
| Max. Throughput averaged over 2 frames | Mbps | 39.915 | 36.001 | 18.012 | 18.012 | 19.950 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: PDSCH is scheduled in PRB numbers from 0 to 25.Note 4: PDSCH is scheduled in PRB numbers from 26 to 51. |

*<Unchanged sections skipped>*

*-----------------Change 6---------------------*

Table A.3.2.1.1-4: PDSCH Reference Channel for FDD (256QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.1-4.1 FDD | R.PDSCH.1-4.2 FDD |  |  |  |
| Channel bandwidth | MHz | 10 | 10 |  |  |  |
| Subcarrier spacing | kHz | 15 | 15 |  |  |  |
| Number of allocated resource blocks | PRBs | 52 | 52 |  |  |  |
| Number of consecutive PDSCH symbols |  | 12 | 12 |  |  |  |
| Allocated slots per 2 frames | Slots | 19 | 19 |  |  |  |
| MCS table |  | 256QAM | 256QAM |  |  |  |
| MCS index |  | 24 | 20 |  |  |  |
| Modulation |  | 256QAM | 256QAM |  |  |  |
| Target Coding Rate |  | 0.82 | 0.67 |  |  |  |
| Number of MIMO layers |  | 1 | 1 |  |  |  |
| Number of DMRS REs |  | 12 | 12 |  |  |  |
| Overhead for TBS determination |  | 0 | 0 |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For Slots i = 1,…, 19 | Bits | 45096 | 36896 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For Slots i = 1,…, 19 | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A | N/A |  |  |  |
|  For Slots i = 1,…, 19 | CBs | 6 | 5 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A |  |  |  |
|  For Slots i = 10, 11 | Bits | 52416 | 52416 |  |  |  |
|  For Slots i = 1,…, 9, 12, …, 19 | Bits | 54912 | 54912 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 42.841 | 35.051 |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

*<Unchanged sections skipped>*

*-----------------Change 7---------------------*

Table A.3.2.2.2-1: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and FR1.30-1A (QPSK)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-1.1 TDD | R.PDSCH.2-1.2 TDD | R.PDSCH.2-1.3 TDD | R.PDSCH.2-1.4 TDD | R.PDSCH.2-1.5 TDD |
| Channel bandwidth | MHz | 40 | 40 | 40 | 40 | 20 |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | PRBs | 106 | 6 | 106 | 106 | 51 |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 | 4 | N/A | N/A | 4 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 7 | 12 | 12 |
| Allocated slots per 2 frames |  | 31 | 31 | 27 | 27 | 31 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAMLowSE | 64QAM |
| MCS index |  | 4 | 4 | 4 | 14 | 4 |
| Modulation |  | QPSK | QPSK | QPSK | QPSK | QPSK |
| Target Coding Rate |  | 0.30 | 0.30 | 0.30 | 0.59 | 0.30 |
| Number of MIMO layers |  | 1 | 1 | 1 | 1 | 1 |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 6 | N/A | N/A | 6 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 18 | 12 | 12 | 12 | 18 |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 | 0 |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 2664 | 144 | N/A | N/A | 1288 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 8064 | 480 | 4608 | 16392 | 3840 |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 16 | 16 | N/A | N/A | 16 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 24 | 16 | 24 | 24 | 24 |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 1 | 1 | N/A | N/A | 1 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 1 | 1 | 1 | 2 | 1 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 20, 21 | Bits | 25440 | 1512 | 13992 | 26712 | 12240 |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 8904 | 504 | N/A | N/A | 4284 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 26712 | 1584 | 15264 | 27984 | 12852 |
| Max. Throughput averaged over 2 frames | Mbps | 11.419 | 0.677 | 6.221 | 22.129 | 5442 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

*<Unchanged sections skipped>*

*-----------------Change 8---------------------*

Table A.3.2.2.2-X: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-X.1 TDD |  |  |  |  |  |
| Channel bandwidth | MHz | 20 |  |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |  |
| Allocated resource blocks | PRBs | 51 |  |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |  |
| Allocated slots per 2 frames |  | 31 |  |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |  |
| MCS index |  | 13 |  |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |  |
| Target Coding Rate |  | 0.48 |  |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |  |
| Number of DMRS Res |  |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 4096 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 12808 |  |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 24 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6}for i from {1,…,39} | Bits | 24 |  |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | CBs | N/A |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 1 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 2 |  |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |  |
|  For Slots i = 20, 21 | Bits | 25704 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 8568 |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 26928 |  |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 18.110 |  |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |  |

*<Unchanged sections skipped>*

*-----------------Change 9---------------------*

Table A.3.2.2.2-3: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-3.1 TDD | R.PDSCH.2-3.2 TDD | R.PDSCH.2-3.3 TDD | R.PDSCH.2-3.4 TDD | R.PDSCH.2-3.5 TDD |
| Channel bandwidth | MHz | 40 | 40 | 40 | 40 | 20 |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | PRBs | 106 | 106 | 53 (Note 3) | 53 (Note 4) | 51 |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 | 4 | 4 | 4 | 4 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames |  | 31 | 31 | 31 | 31 | 31 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| MCS index |  | 19 | 19 | 19 | 19 | 19 |
| Modulation |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Target Coding Rate |  | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Number of MIMO layers |  | 2 | 2 | 2 | 2 | 1 |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 12 | 12 | 12 | 6 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 24 | 24 | 24 | 12 |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 | 0 |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 27144 | 23040 | 11528 | 11528 | 6528 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 83976 | 77896 | 38936 | 38936 | 20496 |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 24 | 24 | 24 | 24 | 24 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6}for i from {1,…,39} | Bits | 24 | 24 | 24 | 24 | 24 |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 4 | 3 | 2 | 2 | 1 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 10 | 10 | 5 | 5 | 3 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 20, 21 | Bits | 160272 | 137376 | 68688 | 68688 | 38556 |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 53424 | 45792 | 22896 | 22896 | 12852 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 167904 | 152640 | 76320 | 76320 | 40392 |
| Max. Throughput averaged over 2 frames | Mbps | 118.796 | 109.768 | 54.869 | 54.869 | 28.975 |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: PDSCH is scheduled in PRB numbers from 0 to 52.Note 4: PDSCH is scheduled in PRB numbers from 53 to 105. |

*<Unchanged sections skipped>*

*-----------------Change 10---------------------*

Table A.3.2.2.2-X1: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-X1.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 20 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 51 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |
| Allocated slots per 2 frames |  | 31 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 19 |  |  |  |  |
| Modulation |  | 64QAM |  |  |  |  |
| Target Coding Rate |  | 0.51 |  |  |  |  |
| Number of MIMO layers |  | 2 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 13064 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 40976 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6}for i from {1,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 2 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 5 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slots i = 20, 21 | Bits | 77112 |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 25704 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 80784 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 57.930 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: PDSCH is scheduled in PRB numbers from 0 to 52.Note 4: PDSCH is scheduled in PRB numbers from 53 to 105. |

*<Unchanged sections skipped>*

*-----------------Change 11---------------------*

Table A.3.2.2.2-4: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (256QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-4.1 TDD | R.PDSCH.2-4.2 TDD | R.PDSCH.2-4.3 TDD |  |  |
| Channel bandwidth | MHz | 40 | 20 | 20 |  |  |
| Subcarrier spacing | kHz | 30 | 30 | 30 |  |  |
| Allocated resource blocks | PRBs | 106 | 51 | 51 |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 | 4 | 4 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 12 |  |  |
| Allocated slots per 2 frames |  | 31 | 31 | 31 |  |  |
| MCS table |  | 256QAM | 256QAM | 256QAM |  |  |
| MCS index |  | 24 | 24 | 20 |  |  |
| Modulation |  | 256QAM | 256QAM | 256QAM |  |  |
| Target Coding Rate |  | 0.82 | 0.82 | 0.67 |  |  |
| Number of MIMO layers |  | 1 | 1 | 1 |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} |  | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 6 | 6 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 12 |  |  |
| Overhead for TBS determination |  | 0 | 0 | 0 |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 29192 | 14088 | 11528 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 92200 | 44040 | 35856 |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 24 | 24 | 24 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 24 | 24 | 24 |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | CBs | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 4 | 2 | 2 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 11 | 6 | 5 |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A |  |  |
|  For Slots i = 20, 21 | Bits | 106848 | 51408 | 51408 |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 35616 | 17136 | 17136 |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 111936 | 53856 | 53856 |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 130.308 | 62.272 | 50.711 |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

*<Unchanged sections skipped>*