**3GPP TSG-RAN WG4 Meeting #99-e *R4-2108510***

 **Electronic Meeting, May.19-27,2021**

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| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** | 0219 | **rev** | **1** | **Current version:** | **15.9.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  |  CR for TS 38.101-4: Updates to Rel-15 PDSCH requirements and CSI requirements |
|  |  |
| ***Source to WG:*** | Huawei,HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Perf |  | ***Date:*** | 2021-05-06 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | 1. TDD slot configuration of FR2 RI test specifed in table 8.4.2.2-1 is not correct.
2. PDSCH is not allocated in the slot for SSB transmission, but the parameter “Number of consecutive PDSCH symbols ” in reference measurement channels with TDD pattern always denotes that PDSCH is allocated in first slot of every 20ms (SSB transmission period)
3. Tbsize calculation for CQI index 1 in table A.4-1, table A.4-2 and table A.4-3 is not correct.
 |
|  |   |
| ***Summary of change:*** | 1. .Change the TDD slot configuration specifed in table 8.4.2.2-1 from “FR1.120-2” to ”FR2.120-2”
2. Added the description in RMC that the number of consecutive PDSCH symbols is 0 for the firsr slot of every 20ms.
3. Recalculated the tbSize for CQI index 1 in table A.4-1, table A.4-2 and table A.4-3
 |
| ***Inte*** |  |
| ***Consequences if not approved:*** | 1. The TDD slot configuration is not correct
2. The PDSCH allocation in the TDD RMC of PDSCH requirements will be wrong.
3. TbSize for RMC of CQI requirements will be wrong.
 |
|  |  |
| ***Clauses affected:*** | A.3.2.2.1; A.3.2.2.2; A.3.2.2.3; A.3.2.2.4;A.3.2.2.5; A.4 |
|  |  |
|  | **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:*** | Merged the corrections in R4-2109331. |
|  |  |
| ***This CR's revision history:*** |  |

*<Start of change>*

# 8.4 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

### 8.4.1 1RX requirements

(Void)

### 8.4.2 2RX requirements

#### 8.4.2.1 FDD

(Void)

#### 8.4.2.2 TDD

The minimum performance requirement in Table 8.4.2.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be ≥ ;

For the parameters specified in Table 8.4.2.2-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.4.2.2-2.

Table 8.4.2.2-1: RI Test (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** | **Test 3** |
| Bandwidth | MHz | 100 | 100 | 100 |
| Subcarrier spacing | kHz | 120 | 120 | 120 |
| Duplex Mode |  | TDD | TDD | TDD |
| TDD Slot Configuration |  | FR2.120-2 | FR2.120-2 | FR2.120-2 |
| SNR  |  dB | 0 | 16 | 16 |
| Propagation channel |  | TDLA30-35 | TDLA30-35 | TDLA30-35 |
| Antenna configuration |  | ULA Low 2x2 | ULA Low 2x2 | XP High 2x2 |
| Beamforming Model |  | As defined in Annex B.4.1 | As defined in Annex B.4.1 | As defined in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 | 4 | 4 |
| CDM Type |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (8,-) | Row 4, (8,-) | Row 4, (8,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (13,-) | (13,-) |
| CSI-RSinterval and offset | slot | 8/1 | 8/1 | 8/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic | Aperiodic | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 2 | 2 | 2 |
| CDM Type |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3 (6,-) | Row 3 (6,-) | Row 3 (6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (13,-) | (13,-) |
| NZP CSI-RS-timeConfiginterval and offset | slot | Not configured | Not configured | Not configured |
| aperiodicTriggeringOffset |  | 0 | 0 | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic | Periodic | Periodic |
| CSI-IM RE pattern |  | Pattern 1 | Pattern 1 | Pattern 1 |
| CSI-IM Resource Mapping(kCSI-IM,lCSI-IM) |  | (8,13) | (8,13) | (8,13) |
| CSI-IM timeConfiginterval and offset | slot | Not configured | Not configured | Not configured |
| ReportConfigType |  | Aperiodic  | Aperiodic | Aperiodic |
| CQI-table |  | Table 1 | Table 1 | Table 1 |
| reportQuantity |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements |  | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements |  | not configured | not configured | not configured |
| cqi-FormatIndicator |  | Wideband | Wideband | Wideband |
| pmi-FormatIndicator |  | Wideband | Wideband | Wideband |
| Sub-band Size | RB | 8 | 8 | 8 |
| csi-ReportingBand |  | 111111111 | 111111111 | 111111111 |
| CSI-Report interval and offset | slot | Not configured | Not configured | Not configured |
| Aperiodic Report Slot Offset |  | 6 | 6 | 6 |
| CSI request |  | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 |
| reportTriggerSize |  | 1 | 1 | 1 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | One State with one Associated Report ConfigurationAssociated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A |
| CodebookSubsetRestriction |  | 010000 for fixed rank 2,010011 for following rank | 000011 for fixed rank 1,010011 for following rank | 000011 for fixed rank 1,010011 for following rank |
| RI Restriction |  | N/A | N/A | N/A |
| Physical channel for CSI report |  | PUSCH | PUSCH | PUSCH |
| CQI/RI/PMI delay  | ms | 1.375 | 1.375 | 1.375 |
| Maximum number of HARQ transmission |  | 1 | 1 | 1 |
| RI Configuration |  | Fixed RI = 2 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 1 and follow RI |
| NOTE 1: Measurements channels are specified in Table A.4-1. TBS.1-1 is used for Rank 1 case. TBS.1-2 is used for Rank 2 case. |

Table 8.4.2.2-2: Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** |
| **1 | N/A | 1.05 | 1.05 |
| **2 | 1.0 | N/A | N/A |

*<End of change>*

*<Start of change>*

## A.3.2 Reference measurement channels for PDSCH performance requirements

For PDSCH reference channels if more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

### A.3.2.2 TDD

#### A.3.2.2.1 Reference measurement channels for SCS 15 kHz FR1

#### A.3.2.2.2 Reference measurement channels for SCS 30 kHz FR1

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 |  |  |
| Channel bandwidth | MHz | 40 | 40 | 40 |  |  |
| Subcarrier spacing | kHz | 30 | 30 | 30 |  |  |
| Allocated resource blocks | PRBs | 106 | 6 | 106 |  |  |
| 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 | N/A |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 7 |  |  |
| Allocated slots per 2 frames |  | 31 | 31 | 27 |  |  |
| MCS table |  | 64QAM | 64QAM | 64QAM |  |  |
| MCS index |  | 4 | 4 | 4 |  |  |
| Modulation |  | QPSK | QPSK | QPSK |  |  |
| Target Coding Rate |  | 0.30 | 0.30 | 0.30 |  |  |
| 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 | N/A |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 18 | 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 | 2664 | 144 | N/A |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 8064 | 480 | 4608 |  |  |
| 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 | 16 | 16 | N/A |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 24 | 16 | 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 | 1 | 1 | N/A |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 1 | 1 | 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 |  |  |
|  For Slots i = 20, 21 | Bits | 25440 | 1512 | 13992 |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 8904 | 504 | N/A |  |  |
|  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 |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 11.419 | 0.677 | 6.221 |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-2: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-2.1 TDD | R.PDSCH.2-2.2 TDD | R.PDSCH.2-2.3 TDD | R.PDSCH.2-2.4 TDD |  |
| Channel bandwidth | MHz | 40 | 40 | 40 | 40 |  |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 |  |
| Allocated resource blocks | PRBs | 106 | 106 | 106 | 106 |  |
| 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 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 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 |  |
| Allocated slots per 2 frames |  | 31 | 31 | 31 | 31 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM |  |
| MCS index |  | 13 | 13 | 13 | 13 |  |
| Modulation |  | 16QAM | 16QAM | 16QAM | 16QAM |  |
| Target Coding Rate |  | 0.48 | 0.48 | 0.48 | 0.48 |  |
| Number of MIMO layers |  | 1 | 2 | 3 | 4 |  |
| 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 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 6 | 12 | 12 |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 24 | 24 |  |
| Overhead for TBS determination |  | 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 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 8456 | 16896 | 22032 | 29192 |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 26632 | 53288 | 73776 | 98376 |  |
| 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 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 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 |  |
| 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 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 2 | 3 | 3 | 4 |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 4 | 7 | 9 | 12 |  |
| 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 |  |
|  For Slots i = 20, 21 | Bits | 53424 | 106848 | 144008 | 193344 |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 17808 | 35616 | 45792 | 61056 |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 55968 | 111936 | 152640 | 203520 |  |
| Max. Throughput averaged over 2 frames | Mbps | 37.644 | 75.318 | 104.004 | 138.646 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

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 |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| 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 | 27144 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 83976 |  |  |  |  |
| 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 | 4 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 10 |  |  |  |  |
| 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 | 160272 |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 53424 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 167904 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 118.796 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

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 |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| 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 |  | 256QAM |  |  |  |  |
| MCS index |  | 24 |  |  |  |  |
| Modulation |  | 256QAM |  |  |  |  |
| Target Coding Rate |  | 0.82 |  |  |  |  |
| 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 | 29192 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 92200 |  |  |  |  |
| 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 | 4 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 11 |  |  |  |  |
| 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 | 106848 |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 35616 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 111936 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 130.308 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-5: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-2

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-5.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} |  | 8 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} |  | 12 |  |  |  |  |
| Allocated slots per 2 frames |  | 31 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 5376 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | Bits | 8456 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | CBs | 2 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i = 20, 21 | Bits | 26712 |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 17808 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,19,22,…,39} | Bits | 27984 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 11.875 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-6: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-3

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-6.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} |  | 8 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |
| Allocated slots per 2 frames |  | 27 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,39} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} | Bits | 5376 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,39} | Bits | 8456 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,39} | CBs | 2 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 10) = {4,8,9} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i = 20, 21 | Bits | 26712 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {3,7} for i from {0,…,39} | Bits | 17808 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,5,6} for i from {1,…,19,22,…,39} | Bits | 27984 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 10.184 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-7: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and CSI-RS overlapped with PDSCH

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-7.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| 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 |  | 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 | 16896 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 53288 |  |  |  |  |
| 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 | 3 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 7 |  |  |  |  |
| 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 Slot i, if mod(i, 10) = {0,5} for i from {1,…,19,22,…,39} | Bits | 103456 |  |  |  |  |
|  For Slots i = 20 | Bits | 98368 |  |  |  |  |
|  For Slots i = 21 | Bits | 106848 |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 35616 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,6} for i from {1,…,19,22,…,39} | Bits | 111936 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 75.318 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-8: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR1.30-1 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-8.1 TDD | R.PDSCH.2-8.2 TDD |  |  |  |
| Channel bandwidth | MHz | 40 | 40 |  |  |  |
| Subcarrier spacing | kHz | 30 | 30 |  |  |  |
| Allocated resource blocks | PRBs | 106 | 106 |  |  |  |
| Number of consecutive PDSCH symbols |  | 12 | 12 |  |  |  |
| Allocated slots per 2 frames |  | 23 | 23 |  |  |  |
| MCS table |  | 64QAM | 64QAM |  |  |  |
| MCS index |  | 13 | 13 |  |  |  |
| Modulation |  | 16QAM | 16QAM |  |  |  |
| Target Coding Rate |  | 0.48 | 0.48 |  |  |  |
| Number of MIMO layers |  | 1 | 2 |  |  |  |
| Number of DMRS REs (Note 3) |  | 24 | 24 |  |  |  |
| Overhead for TBS determination |  | 0 | 0 |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i = 20 | Bits | 24576 | 49176 |  |  |  |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24576 | 49176 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i = 20 | Bits | 24 | 24 |  |  |  |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | CBs | N/A | N/A |  |  |  |
|  For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | CBs | N/A | N/A |  |  |  |
|  For Slot i = 20 | CBs | 3 | 6 |  |  |  |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | CBs | 3 | 6 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i = 20 | Bits | 48336 | 96672 |  |  |  |
|  For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 50880 | 101760 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 28.2624 | 56.5524 |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data |

Table A.3.2.2.2-9: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-4 (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-9.1 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) = {4,5} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} |  | 4 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} 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) = {4,5} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} |  | 6 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} 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) = {4,5} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} | Bits | 13064 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} for i from {1,…,39} | Bits | 40976 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} for i from {1,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} | CBs | 2 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} for i from {1,…,39} | CBs | 5 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slots i = 20, 21 | Bits | 77112 |  |  |  |  |
|  For Slot i, if mod(i, 10) = 3 for i from {0,…,39} | Bits | 25704 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,6,7,8,9} 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 frames |

Table A.3.2.2.2-10: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and HST scenario

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-10.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| 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} |  | 18 |  |  |  |  |
| 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 | 8456 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 25608 |  |  |  |  |
| 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 | 4 |  |  |  |  |
| 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 = 1,2,21,22 | Bits | 52176(Note 3) |  |  |  |  |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 17808 |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,20,23,…,39} | Bits | 53424 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 36.262 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Binary Channel Bits are calculated under assumption of 52 PRBs TRS allocation. |

Table A.3.2.2.2-11: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-5

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-11.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} |  | 10 |  |  |  |  |
| Allocated slots per 2 frames |  | 31 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} |  | 18 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} |  | 18 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | Bits | 8064 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | Bits | 6528 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | CBs | 1 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i = 20 | Bits | 25440 |  |  |  |  |
|  For Slot i = 21 | Bits | 20352 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,19,22,…,39} | Bits | 26712 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,19,22,…,39} | Bits | 21624 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 6.893 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.2-12: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-6

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-12.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} |  | 8 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} |  | 10 |  |  |  |  |
| Allocated slots per 2 frames |  | 31 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} |  | 18 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} |  | 18 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} |  | 18 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | Bits | 8064 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | Bits | 4992 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} | Bits | 6528 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,39} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {0,…,39} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} | CBs | 1 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,39} | Bits | N/A |  |  |  |  |
|  For Slot i = 20 | Bits | 25440 |  |  |  |  |
|  For Slot i = 21 | Bits | 15264 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 0 for i from {1,…,19,22,…,39} | Bits | 26712 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 1 for i from {1,…,19,22,…,39} | Bits | 16536 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {0,…,39} | Bits | 21624 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 9.389 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

#### A.3.2.2.3 Reference measurement channels for SCS 60 kHz FR1

#### A.3.2.2.4 Reference measurement channels for SCS 60 kHz FR2

Table A.3.2.2.4-1: PDSCH Reference Channel for TDD UL-DL pattern FR2.60-1 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.4-1.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 50 |  |  |  |  |
| Subcarrier spacing | kHz | 60 |  |  |  |  |
| Allocated resource blocks | PRBs | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 79} |  | 10 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 59 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 13 |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |
| Target Coding Rate |  | 0.48 |  |  |  |  |
| Number of MIMO layers |  | 2 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 79} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 79} | Bits | 25608 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79} | Bits | 34816 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 79} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 79} | CBs | 4 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79} | CBs | 5 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,79} | Bits | N/A |  |  |  |  |
|  For Slot i = 40, 41 | Bits | 69960 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {4,…, 79} | Bits | 54912 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,39,42,…,79} | Bits | 73128 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 93.499 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

#### A.3.2.2.5 Reference measurement channels for SCS 120 kHz FR2

Table A.3.2.2.5-1: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 and FR2.120-1A (QPSK)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-1.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 100 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Allocated resource blocks | PRBs | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 9 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 127 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 3624 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 5504 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 16 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | CBs | 1 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slots i = 80, 81 | Bits | 17490 |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 12210 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,79,82,…,159} | Bits | 18282 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 31.942 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.5-2: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-2.1 TDD | R.PDSCH.5-2.2 TDD | R.PDSCH.5-2.3 TDD |  |  |
| Channel bandwidth | MHz | 100 | 100 | 200 |  |  |
| Subcarrier spacing | kHz | 120 | 120 | 120 |  |  |
| Allocated resource blocks | PRBs | 66 | 66 | 132 |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 9 | 9 | 9 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 13 | 13 | 13 |  |  |
| Allocated slots per 2 frames |  | 127 | 127 | 127 |  |  |
| MCS table |  | 64QAM | 64QAM | 64QAM |  |  |
| MCS index |  | 13 | 13 | 13 |  |  |
| Modulation |  | 16QAM | 16QAM | 16QAM |  |  |
| Target Coding Rate |  | 0.48 | 0.48 | 0.48 |  |  |
| Number of MIMO layers |  | 1 | 2 | 2 |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 12 | 12 | 12 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 12 | 12 | 12 |  |  |
| Overhead for TBS determination |  | 6 | 6 | 6 |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 11272 | 22536 | 45096 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 17424 | 34816 | 69672 |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 24 | 24 | 24 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 24 | 24 | 24 |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | CBs | N/A | N/A | N/A |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | CBs | 2 | 3 | 6 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | CBs | 3 | 5 | 9 |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A | N/A | N/A |  |  |
|  For Slots i = 80, 81 | Bits | 36564 | 69960 | 139920 |  |  |
|  For Slots i = 82, 83 | Bits | 34980 | 73128 | 146256 |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 24420 | 48840 | 97680 |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,79,84,…,159} | Bits | 36564 | 73128 | 146256 |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 100.799 | 201.434 | 403.096 |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.5-3: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-3.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 100 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Allocated resource blocks | PRBs | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 9 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 127 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 18 |  |  |  |  |
| Modulation |  | 64QAM |  |  |  |  |
| Target Coding Rate |  | 0.46 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 16136 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 25104 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | CBs | 2 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,159} | CBs | 3 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slots i = 80, 81 | Bits | 52470 |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…, 159} | Bits | 36630 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,79,82,…,159} | Bits | 54846 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 145.062 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.5-4: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (QPSK)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-4.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 100 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Allocated resource blocks | PRBs | 6 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 10 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 119 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 2 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 736 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 1032 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 16 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 16 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | CBs | 1 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | CBs | 1 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i = 80, 81 | Bits | 3180 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {4,…, 159} | Bits | 2496 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79,82,…,159} | Bits | 3324 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 5.548 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.5-5: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (16QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-5.1 TDD | R.PDSCH.5-5.2 TDD |  |  |  |
| Channel bandwidth | MHz | 100 | 50 |  |  |  |
| Subcarrier spacing | kHz | 120 | 120 |  |  |  |
| Allocated resource blocks | PRBs | 66 | 32 |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 10 | 10 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 13 | 13 |  |  |  |
| Allocated slots per 2 frames |  | 119 | 119 |  |  |  |
| MCS table |  | 64QAM | 64QAM |  |  |  |
| MCS index |  | 13 | 13 |  |  |  |
| Modulation |  | 16QAM | 16QAM |  |  |  |
| Target Coding Rate |  | 0.48 | 0.48 |  |  |  |
| Number of MIMO layers |  | 2 | 2 |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 12 | 12 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 12 | 12 |  |  |  |
| Overhead for TBS determination |  | 6 | 6 |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 25608 | 12552 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 34816 | 16896 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 24 | 24 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | CBs | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | CBs | 4 | 2 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | CBs | 5 | 3 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A | N/A |  |  |  |
|  For Slot i = 80, 81 | Bits | 69960 | 33920 |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {4,…, 159} | Bits | 54912 | 26624 |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79,82,…,159} | Bits | 73128 | 35456 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 188.739 | 91.843 |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.2.5-6: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (64QAM)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-6.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 100 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Allocated resource blocks | PRBs | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 10 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 119 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 17 |  |  |  |  |
| Modulation |  | 64QAM |  |  |  |  |
| Target Coding Rate |  | 0.43 |  |  |  |  |
| Number of MIMO layers |  | 2 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} |  | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} |  | 12 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 34816 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 47112 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | Bits | 24 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {1,…, 159} | CBs | 5 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,159} | CBs | 6 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0 and Slot i, if mod(i, 4) = 3 for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i = 80, 81 | Bits | 114940 |  |  |  |  |
|  For Slot i, if mod(i, 4) = 2 for i from {4,…, 159} | Bits | 82368 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {1,…,79,82,…,159} | Bits | 109692 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 255.724 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

*<End of change>*

*<Start of change>*

# A.4 CSI reference measurement channels

This clause defines the DL signal applicable to the reporting of channel status information (Clauses 6 and 8).

Tables in this clause specifies the mapping of CQI index to Information Bit payload, which complies with the CQI definition specified in clause 5.2.2.1 of TS 38.214 [12] and with MCS definition specified in clause 5.1.3 of TS 38.214 [12].

Table A.4-1: Mapping of CQI Index to Information Bit payload (CQI table 1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | TBS.1-1 | TBS.1-2 |  |  |  |  |
| MCS table | 64QAM |
| Number of allocated PDSCH resource blocks | 66 | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols | 12 | 12 |  |  |  |  |
| Number of PDSCH MIMO layers | 1 | 2 |  |  |  |  |
| Number of DMRS REs (Note 1) | 24 | 24 |  |  |  |  |
| Overhead for TBS determination | 6 | 6 |  |  |  |  |
| Available RE-s | 7590 | 7590 |  |  |  |  |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A |  |  |  |  |
| 1 | 0.2344 | 0 | QPSK | 1800 | 3624 |  |  |  |  |
| 2 | 0.2344 | 0 | 1800 | 3624 |  |  |  |  |
| 3 | 0.3770 | 2 | 2856 | 5640 |  |  |  |  |
| 4 | 0.6016 | 4 | 4480 | 8968 |  |  |  |  |
| 5 | 0.8770 | 6 | 6528 | 13064 |  |  |  |  |
| 6 | 1.1758 | 8 | 8712 | 17928 |  |  |  |  |
| 7 | 1.4766 | 11 | 16QAM | 11016 | 22032 |  |  |  |  |
| 8 | 1.9141 | 13 | 14343 | 28680 |  |  |  |  |
| 9 | 2.4063 | 15 | 17928 | 35856 |  |  |  |  |
| 10 | 2.7305 | 18 | 64QAM | 20496 | 40976 |  |  |  |  |
| 11 | 3.3223 | 20 | 25104 | 50184 |  |  |  |  |
| 12 | 3.9023 | 22 | 29192 | 58384 |  |  |  |  |
| 13 | 4.5234 | 24 | 33816 | 67584 |  |  |  |  |
| 14 | 5.1152 | 26 | 38936 | 77896 |  |  |  |  |
| 15 | 5.5547 | 28 | 42016 | 83976 |  |  |  |  |
| Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-1 of TS 38.214 [12] |

Table A.4-2: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 1 and Rank 2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | TBS.2-1 | TBS.2-2 | TBS.2-3 | TBS.2-4 | TBS.2-5 | TBS.2-6 |
| MCS table | 256QAM |
| Number of allocated PDSCH resource blocks | 52 | 52 | 106 | 106 | 8 | 16 |
| Number of consecutive PDSCH symbols | 12 | 12 | 12 | 12 | 12 | 12 |
| Number of PDSCH MIMO layers | 1 | 2 | 1 | 2 | 1 | 1 |
| Number of DMRS REs (Note 1) | 24 | 24 | 24 | 24 | 24 | 24 |
| Overhead for TBS determination | 0 | 0 | 0 | 0 | 0 | 0 |
| Available RE-s for PDSCH | 6240 | 6240 | 12720 | 12720 | 960 | 1920 |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A | N/A | N/A |
| 1 | 0.2344 | 0 | QPSK | 1480 | 2976 | 2976 | 5896 | 224 | 456 |
| 2 | 0.3770  | 1 | 2408 | 4744 | 4744 | 9480 | 368 | 736 |
| 3 | 0.8770  | 3 | 5504 | 11016 | 11016 | 22536 | 848 | 1736 |
| 4 | 1.4766  | 5 | 16QAM | 9224 | 18432 | 18960 | 37896 | 1416 | 2856 |
| 5 | 1.9141  | 7 | 12040 | 24072 | 24576 | 49176 | 1864 | 3752 |
| 6 | 2.4063  | 9 | 15112 | 30216 | 30728 | 61480 | 2408 | 4608 |
| 7 | 2.7305  | 11 | 64QAM | 16896 | 33816 | 34816 | 69672 | 2600 | 5248 |
| 8 | 3.3223  | 13 | 20496 | 40976 | 42016 | 83976 | 3240 | 6400 |
| 9 | 3.9023  | 15 | 24576 | 49176 | 49176 | 98376 | 3752 | 7424 |
| 10 | 4.5234  | 17 | 28168 | 56368 | 57376 | 114776 | 4352 | 8712 |
| 11 | 5.1152  | 19 | 31752 | 63528 | 65576 | 131176 | 4864 | 9736 |
| 12 | 5.5547  | 21 | 256QAM | 34816 | 69672 | 69672 | 139376 | 5248 | 10760 |
| 13 | 6.2266 | 23 | 38936 | 77896 | 79896 | 159880 | 6016 | 12040 |
| 14 | 6.9141 | 25 | 43032 | 86040 | 88064 | 176208 | 6656 | 13320 |
| 15 | 7.4063  | 27 | 46104 | 92200 | 94248 | 188576 | 7040 | 14088 |
| Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-2 of TS 38.214 [12] |

**Table A.4-3: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 3 and Rank 4)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| TBS Scheme | TBS.3-1 | TBS.3-2 | TBS.3-3 | TBS.3-4 |  |  |
| MCS table | 256QAM |
| Number of allocated PDSCH resource blocks | 52 | 52 | 106 | 106 |  |  |
| Number of consecutive PDSCH symbols | 12 | 12 | 12 | 12 |  |  |
| Number of PDSCH MIMO layers | 3 | 4 | 3 | 4 |  |  |
| Number of DMRS REs (Note 1) | 24 | 24 | 24 | 24 |  |  |
| Overhead for TBS determination | 0 | 0 | 0 | 0 |  |  |
| Available RE-s for PDSCH | 6240 | 6240 | 12720 | 12720 |  |  |
| CQI index | Spectral efficiency | MCS index | Modulation | Information Bit Payload per Slot |
| 0 | OOR | OOR | OOR | N/A | N/A | N/A | N/A |  |  |
| 1 | 0.2344  | 0 | QPSK | 4360 | 5896 | 8976 | 11784 |  |  |
| 2 | 0.3770  | 1 | 7048 | 9480 | 14344 | 18976 |  |  |
| 3 | 0.8770  | 3 | 16392 | 22032 | 33816 | 45096 |  |  |
| 4 | 1.4766  | 5 | 16QAM | 27656 | 36896 | 56368 | 75792 |  |  |
| 5 | 1.9141  | 7 | 35856 | 48168 | 73776 | 98376 |  |  |
| 6 | 2.4063  | 9 | 45096 | 60456 | 92200 | 122976 |  |  |
| 7 | 2.7305  | 11 | 64QAM | 51216 | 67584 | 104496 | 139376 |  |  |
| 8 | 3.3223  | 13 | 62504 | 81976 | 127080 | 167976 |  |  |
| 9 | 3.9023  | 15 | 73776 | 98376 | 147576 | 196776 |  |  |
| 10 | 4.5234  | 17 | 83976 | 112648 | 172176 | 229576 |  |  |
| 11 | 5.1152  | 19 | 96264 | 127080 | 196776 | 262376 |  |  |
| 12 | 5.5547  | 21 | 256QAM | 104496 | 139376 | 213176 | 278776 |  |  |
| 13 | 6.2266 | 23 | 116792 | 155776 | 237776 | 319784 |  |  |
| 14 | 6.9141 | 25 | 129128 | 172176 | 262376 | 352440 |  |  |
| 15 | 7.4063  | 27 | 139376 | 184424 | 278776 | 376896 |  |  |
| Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without dataNote 2: PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DLNote 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicityNote 4: Spectral efficiency is based on MCS Table defined in Table 5.1.3.1-2 of TS 38.214 [12] |

*<End of change>*