**3GPP TSG- RAN WG4 Meeting #100-eR4-2115672**

**Electronic Meeting, August 16-27, 2021**

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| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-4** | **CR** |  | **rev** |  | **Current version:** | **16.5.0** |  |
|  |
| *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 to TS38.101-4 on URLLC requirements (Rel-16) |
|  |  |
| ***Source to WG:*** | MediaTek |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_L1enh\_URLLC-Perf |  | ***Date:*** | 2021-08-06 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *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. Some parts in agreed CR R4-2108547 are not implemented
2. R.PDSCH. 1-2.5 FDD is not for setcions 5.2.2.1.8 and 5.2.3.1.8
3. R.PDSCH. 2-2.5 TDD is not for setcions 5.2.2.2.8 and 5.2.3.2.8
4. R.PDSCH. 5-10.1 TDD is not for section 7.2.2.2.2
5. Redundant “space” in section 7.2.2.2.3
6. Reference channel number should follow the last two digit of table number
 |
|  |  |
| ***Summary of change:*** | 1. Add R.PDSCH. 1-2.6 FDD in Table A.3.2.1.1-2 according to R4-2103901, also modifiy Tables 5.2.2.1.8-3 and 5.2.3.1.8-3
2. Add R.PDSCH. 2-2.6 TDD in Table A.3.2.2.2-2 according to R4-2103901, also modifiy Tables 5.2.2.2.8-3 and 5.2.3.2.8-3
3. Moddify R.PDSCH. 5-10.1 TDD to R.PDSCH. 5-11.1 TDD in Table A.3.2.2.5-11. Aslo modify the Table 7.2.2.2.2-3
4. Modifty the reference channel R.PDSCH.1-16.1 TDD, R.PDSCH.1-17.1 TDD to R.PDSCH.2-16.1 TDD, R.PDSCH.2-17.1 TDD respectively. Also modify Tables 5.2.2.2.6-3, 5.2.2.2.7-3, 5.2.3.2.6-3 and 5.2.3.2.7-3
5. Remove the redundant ‘space’ in section 7.2.2.2.3
 |
|  |  |
| ***Consequences if not approved:*** | 1. Wrong reference channels for sections 5.2.2.1.8, 5.2.3.1.8, 5.2.2.2.8 and 5.2.3.2.8
2. Wrong code rate in Table 5.2.2.2.8-3
3. Wrong reference channel in Table A.3.2.2.5-11 and Table 7.2.2.2.2-3
 |
|  |  |
| ***Clauses affected:*** | 5.2.2.2.8, 5.2.3.2.8, A.3.2.2.2, 7.2.2.2.3, A.3.2.2.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.521-4 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**START OF CHANGE 1**

5.2.2.1.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.2.1.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | 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. 1-2.6 FDD | 10 / 15 | 16QAM0.64 | TDLA30-10 | 2x2, ULA Low | 70 | 10.5 |

**END OF CHANGE 1**

**START OF CHANGE 2**

5.2.2.2.6 Minimum requirements for PDSCH repetitions over multiple slots

<SKIP UNCHANGED PART>

**Table 5.2.2.2.6-3: 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** |
| **Target BLER** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 1%(Note 1) | 1.4 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

**END OF CHANGE 2**

**START OF CHANGE 3**

5.2.2.2.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

<SKIP UNCHANGED PART>

**Table 5.2.2.2.7-3: 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.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10  | 2x2, ULA Low | 70 | 0.6 |

**END OF CHANGE 3**

**START OF CHANGE 4**

5.2.2.2.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.2.2.8-3: 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. 2-2.6 TDD | 40 / 30 | 16QAM0.64 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 12.5 |

**END OF CHANGE 4**

**START OF CHANGE 5**

5.2.3.1.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.3.1.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | 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. 1-2.6 FDD | 10 / 15 | 16QAM0.64 | TDLA30-10 | 2x4, ULA Low | 70 | 6. 6 |

**END OF CHANGE 5**

**START OF CHANGE 6**

5.2.3.2.6 Minimum requirements for PDSCH repetitions over multiple slots

<SKIP UNCHANGED PART>

**Table 5.2.3.2.6-3: 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** |
| **Target BLER** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 1%(Note 1) | -2.6 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

**END OF CHANGE 6**

**START OF CHANGE 7**

5.2.3.2.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

<SKIP UNCHANGED PART>

**Table 5.2.3.2.7-3: 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.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x4, ULA Low | 70 | -2.5 |

**END OF CHANGE 7**

**END OF CHANGE 8**

5.2.3.2.8 Minimum requirements for PDSCH pre-emption

<SKIP UNCHANGED PART>

Table 5.2.3.2.8-3: 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. 2-2.6 TDD | 40 / 30 | 16QAM0.64 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |

**END OF CHANGE 8**

**START OF CHANGE 9**

<SKIP UNCHANGED PART>

**Table 7.2.2.2.2-3: Minimum performance for Rank 1 (FRC)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Target BLER** | **SNR (dB)** |
| 1-1 | R.PDSCH. 5-11.1 TDD | 100 / 120 | 16QAM,0.37 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 1% (Note 1) | -1.1 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

7.2.2.2.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 7.2.2.2.3-3, with the addition of test parameters in Table 7.2.2.2. 3-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type B scheduling.

The test purposes are specified in Table 7.2.2.2.3-1.

**Table 7.2.2.2.3-1: Test purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH mapping Type B performance under 2 receive antenna conditions | 1-1 |

**Table 7.2.2.2.3-2: Test parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration | Number of PDCCH candidates and aggregation levels |  | 1/AL8 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S)  |  | 1 |
| Length (L) |  | 2 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| 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 |  | 0 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 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.1.3 |

**Table 7.2.2.2.3-3: 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. 5-1.2 TDD | 100 / 120 | QPSK, 0.30 | FR2.120-1 | [TDLA30-75] | 2x2, ULA Low | 70 | 1.3 |

**END OF CHANGE 9**

**START OF CHANGE 10**

A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

<SKIP UNCHANGED PART>

Table A.3.2.1.1-1: PDSCH Reference Channel for FDD (QPSK)

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.1-1.1 FDD | R.PDSCH.1-1.2 FDD | R.PDSCH.1-1.3 FDD | R.PDSCH.1-1.4 FDD |  |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |
| Number of allocated resource blocks | PRBs | 52 | 6 | 52 | 52 |  |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 7 | 12 |  |
| Allocated slots per 2 frames | Slots | 19 | 19 | 19 | 19 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAMLowSE |  |
| MCS index |  | 4 | 4 | 4 | 14 |  |
| Modulation |  | QPSK | QPSK | QPSK | QPSK |  |
| Target Coding Rate |  | 0.30 | 0.30 | 0.30 | 0.59 |  |
| Number of MIMO layers |  | 1 | 1 | 1 | 1 |  |
| Number of DMRS REs |  | 18 | 12 | 12 | 12 |  |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A |  |
|  For Slots i = 1,…, 19 | Bits | 3904 | 480 | 2280 | 8064 |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A |  |
|  For Slots i = 1,…, 19 | Bits | 24 | 16 | 16 | 24 |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A | N/A | N/A | N/A |  |
|  For Slots i = 1,…, 19 | CBs | 1 | 1 | 1 | 1 |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A |  |
|  For Slots i = 10, 11 | Bits | 12480 | 1512 | 6864 | 13104 |  |
|  For Slots i =1,…, 9, 12, …, 19 | Bits | 13104 | 1584 | 7488 | 13728 |  |
| Max. Throughput averaged over 2 frames | Mbps | 3.709 | 0.456 | 2.166 | 7.661 |  |
| 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.3.2.1.1-2: PDSCH Reference Channel for FDD (16QAM)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** |  | **Value** |
| Reference channel |  | R.PDSCH.1-2.1 FDD | R.PDSCH.1-2.2 FDD | R.PDSCH.1-2.3 FDD | R.PDSCH.1-2.4 FDD | R.PDSCH.1-2.5 FDD | R.PDSCH.1-2.6 FDD |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 | 10 | 10 |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 | 15 | 15 |
| Number of allocated resource blocks | PRBs | 52 | 52 | 52 | 52 | 52 | 52 |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 | 12 | 12 |
| Allocated slots per 2 frames | Slots | 19 | 19 | 19 | 19 | 19 | 19 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAMLowSE | 64QAM |
| MCS index |  | 13 | 13 | 13 | 13 | 19 | 16 |
| Modulation |  | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 0.48 | 0.48 | 0.48 | 0.48 | 0.54 | 0.64 |
| Number of MIMO layers |  | 1 | 2 | 3 | 4 | 2 | 1 |
| Number of DMRS REs |  | 12 | 12 | 24 | 24 | 12 | 12 |
| Overhead for TBS determination |  | 0 | 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 | N/A |
|  For Slots i = 1,…, 19 | Bits | 13064 | 26120 | 35856 | 48168 | 29704 | 17424 |
| Transport block CRC per Slot |  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 1,…, 19 | Bits | 24 | 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 | N/A |
|  For Slots i = 1,…, 19 | CBs | 2 | 4 | 5 | 6 | 4 | 3 |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A | N/A | N/A | N/A | N/A | N/A |
|  For Slots i = 10, 11 | Bits | 26208 | 52416 | 71136 | 94848 | 49920 | 26208 |
|  For Slots i = 1,…, 9, 12, …, 19 | Bits | 27456 | 54912 | 74880 | 99840 | 54912 | 27456 |
| Max. Throughput averaged over 2 frames | Mbps | 12.411 | 24.814 | 34.063 | 45.760 | 28.219 | 16.553 |
|  | 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 10**

**START OF CHANGE 11**

A.3.2.2.2 Reference measurement channels for SCS 30 kHz FR1

<SKIP UNCHANGED PART>

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 | R.PDSCH.2-2.5 TDD | R.PDSCH.2-2.6 TDD |
| Channel bandwidth | MHz | 40 | 40 | 40 | 40 | 40 | 40 |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | PRBs | 106 | 106 | 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 | N/A | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 4 | 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 | 12 |
| Allocated slots per 2 frames |  | 31 | 31 | 31 | 31 | 31 | 31 |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAMLowSE | 64QAM |
| MCS index |  | 13 | 13 | 13 | 13 | 19 | 16 |
| Modulation |  | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Target Coding Rate |  | 0.48 | 0.48 | 0.48 | 0.48 | 0.54 | 0.64 |
| Number of MIMO layers |  | 1 | 2 | 3 | 4 | 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 | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 6 | 12 | 12 | 6 | 6 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 | 24 | 24 | 12 | 12 |
| Overhead for TBS determination |  | 0 | 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 | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 8456 | 16896 | 22032 | 29192 | 19464 | 11528 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 26632 | 53288 | 73776 | 98376 | 60456 | 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 | 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 | 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 | 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 | N/A |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | CBs | 2 | 3 | 3 | 4 | 3 | 2 |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 4 | 7 | 9 | 12 | 8 | 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 | N/A | N/A | N/A |
|  For Slots i = 20, 21 | Bits | 53424 | 106848 | 144008 | 193344 | 101760 | 53424 |
|  For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 17808 | 35616 | 45792 | 61056 | 35616 | 17808 |
|  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 | 111936 | 55968 |
| Max. Throughput averaged over 2 frames | Mbps | 37.644 | 75.318 | 104.004 | 138.646 | 85.508 | 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 |

**END OF CHANGE 11**

**START OF CHANGE 12**

**Table A.3.2.2.2-16: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-16.1 TDD |  R.PDSCH.2-16.2 TDD |  |  |  |
| Channel bandwidth | MHz | 40 | 40 |  |  |  |
| Subcarrier spacing | kHz | 30 | 30 |  |  |  |
| Allocated resource blocks | PRBs | 106 | 106 |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0, 7} for i from {0,…,39} |  | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 |  |  |  |
| Allocated slots per 2 frames |  | 24 | 24 |  |  |  |
| MCS table |  | 64QAMLowSE | 64QAMLowSE |  |  |  |
| MCS index |  | 19 | 19 |  |  |  |
| Modulation |  | 16QAM | 16QAM |  |  |  |
| Target Coding Rate |  | 0.54 | 0.54 |  |  |  |
| Number of MIMO layers |  | 1 | 1 |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0, 7} for i from {0,…,39} |  | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 12 |  |  |  |
| Overhead for TBS determination |  | 0 | 0 |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | Bits | 30216 | 30216 |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | Bits | 24 | 24 |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | CBs | N/A | N/A |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,39} | CBs | 2 | 2 |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i, if mod(i, 10) = {0,7,8,9} for i from {0,…,39} | Bits | N/A | N/A |  |  |  |
|  For Slot i = 21 | Bits | 53424 | 50880 |  |  |  |
|  For Slot i, if mod(i, 10) = {1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 55968 | 55968 |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 18.130(NOTE 3) | 18.130(NOTE 4) |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Throughput is calculated under assumption of aggregation factor 2.Note 4: Throughput is calculated under assumption of repetition number 2 |

**END OF CHANGE 12**

**START OF CHANGE 13**

**Table A.3.2.2.2-17: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-2**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.2-17.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 40 |  |  |  |  |
| Subcarrier spacing | kHz | 30 |  |  |  |  |
| Allocated resource blocks | PRBs | 106 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} |  | 2 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} |  | N/A |  |  |  |  |
| Allocated slots per 2 frames |  | 8 |  |  |  |  |
| MCS table |  |  |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.3 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} |  | 6 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} |  | N/A |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 1160 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | Bits | N/A |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 16 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | Bits | N/A |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  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 | N/A |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i, if mod(i, 5) = 3 for i from {0,…,39} | Bits | 3816 |  |  |  |  |
|  For Slot i, if mod(i, 5) = {0,1,2} for i from {1,…,39} | Bits | N/A |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 0.464 |  |  |  |  |
| 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 13**

**START OF CHANGE 14**

A.3.2.2.5 Reference measurement channels for SCS 120 kHz FR2

**Table A.3.2.2.5-11: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Reference channel |  | R.PDSCH.5-11.1 TDD |  |  |  |  |
| Channel bandwidth | MHz | 100 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Allocated resource blocks | PRBs | 66 |  |  |  |  |
| Number of consecutive PDSCH symbols |  |  |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} |  | 13 |  |  |  |  |
| Allocated slots per 2 frames |  | 78 |  |  |  |  |
| MCS table |  | 64QAMLowSE |  |  |  |  |
| MCS index |  | 16 |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |
| Target Coding Rate |  | 0.37 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  |  |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 6 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slots 0, 1 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} | Bits | 13320 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slots 0, 1 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slots 0, 1 and Slot i, if mod(i, 4) = {2,3} for i from {0,…,159} | CBs | N/A |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} | CBs | 2 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slots 0,1 and Slot i, if mod(i, 4) = {2, 3} for i from {0,…,159} | Bits | N/A |  |  |  |  |
|  For Slot i = 80, 81 | Bits | 34980 |  |  |  |  |
|  For Slot i, if mod(i, 4) = {0,1} for i from {2,…,159} | Bits | 36564 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 25.974(Note 3) |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 framesNote 3: Throughput is calculated under assumption of aggregation factor 2. |

**END OF CHANGE 14**