**3GPP TSG-RAN WG4 Meeting #111 *R4-2407115***

**Fukuoka, Japan, 20-24 May 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **0512** | **rev** | **-** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *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:*** | Big CR for UE advanced receiver performance requirements for MU-MIMO | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | China Telecom | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_demod\_enh3-Perf | | | | |  | ***Date:*** | | | 2024-05-28 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RAN4 has agreed to introduce UE performance requirements for advanced receiver for MU-MIMO. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Big draft CR to include changes from the following endorsed draft CRs:   1. R4-2409968, DraftCR on RMC for Advanced Receivers, Nokia. 2. R4-2409884, Draft CR on applicability rule of advanced receiver for MU-MIMO, Samsung, Huawei, HiSilicon 3. R4-2409885, draft CR to 38.101-4: Introduction of FDD 2Rx PDSCH requirements for advanced receiver for MU-MIMO, Ericsson 4. R4-2409886, Draft CR for 38.101-4 Introduction of definition for advanced receiver for MU-MIMO, Huawei,HiSilicon 5. R4-2409887, Draft CR to 38.101-4: PDSCH requirements of MU-MIMO advanced receiver in 4Rx TDD, MediaTek 6. R4-2409850, Draft CR to TS38.101-4: Introduction of TDD 2Rx requirements for advanced receiver for MU-MIMO, ZTE Corporation, Sanechips 7. R4-2409883, DraftCR to 38.101-4 on FDD 4Rx requirements for advanced receiver for MU-MIMO, Apple | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be no requirements for advanced receiver for MU-MIMO. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1  5.1.1.3 5.1.1.4  5.2.2.1.16 5.2.2.2.17 5.2.3.1.16 5.2.3.2.17  A.3.2.1.5 and A.3.2.2.7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS/TR 38.521-4 CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | There are additional changes from the big CR author with change track’ Editorial - China Telecom’. | | | | | | | | |

**<Start of change R4-2409886>**

3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**DL BWP**: DL bandwidth part as defined in TS 38.213 [11].

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [13].

**Enhanced Receiver Type 1:** SU-MIMO interference mitigation advanced receiver [14]

- R-ML (reduced complexity ML) receiver with enhanced inter-stream interference suppression for SU-MIMO transmissions with rank 2 with 2 RX antennas

* R-ML (reduced complexity ML) receiver with enhanced inter-stream interference suppression for SU-MIMO transmissions with rank 2, 3, and 4 with 4 RX antennas

**Enhanced Receiver Type 2:** MU-MIMO interference mitigation advanced receiver [14]

- R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression, for MU-MIMO up to maxNumberMIMO-LayersPDSCH layers across target and co-scheduled UEs with 2 RX and 4RX antennas, when co-scheduled UE(s)’ modulation order is explicitly signaled by DCI index 1-5 in Table 7.3.1.2.2-12 of TS38.212 [10].

- R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO for 2 layers across target and co-scheduled UEs with 2RX and 4RX when the co-scheduled UE information with DCI index 6 or 7 in Table 7.3.1.2.2-12 of TS38.212 [10] is signalled.

- R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO for 2 layers across target and co-scheduled UEs with 2RX and maxNumberMIMO-LayersPDSCH layers across target and co-scheduled UEs with 4RX when the co-scheduled UE information with DCI index 6 in Table 7.3.1.2.2-12 of TS38.212 [10] is signalled.

**FR1**: Frequency range 1 as defined in clause 5.1 of TS 38.101-3 [8].

**FR2**: Frequency range 2 as defined in clause 5.1 of TS 38.101-3 [8].

**RedCap**: A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

**SSB:** SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [9].

**<End of change R4-2409886>**

**<Start of change R4-2409884>**

#### 5.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 5.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 5.1.1.3-1: Requirements applicability for optional UE features

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE feature/capability [14] | Test type | | Test list | Applicability notes |
| SU-MIMO Interference Mitigation advanced receiver | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 3-1)  Clause 5.2.3.1.1 (Test 5-1) |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 3-1)  Clause 5.2.3.2.1 (Test 5-1) |  |
| … | … | … | … | … |
| Support for PDCCH with intra-slot repetition *(mTRP-PDCCH-Repetition-r17)* | FR1 FDD | PDCCH | Clause 5.3.2.1.5  Clause 5.3.3.1.4 |  |
|  | FR1 TDD | PDCCH | Clause 5.3.2.2.5  Clause 5.3.3.2.4 |  |
| Support for TDD-TDD intra-band non-colocated NR-CA deployment (intraBandNR-CA-non-collocated-r18) | FR1 TDD | PDSCH | Clause 5.2A.2.6 | The requirements apply on in case the UE indicates support of 256QAM modulation scheme for PDSCH for FR1 (pdsch-256QAM-FR1) |
| Support for MU-MIMO Interference Mitigation advanced receiver (R-ML), when co-scheduled UE(s)’ modulation order is explicitly signalled by DCI index 1-5 in Table 7.3.1.2.2-12 of TS38.212 [10]. (advReceiver-MU-MIMO-r18) | FR1 FDD | PDSCH | Clause 5.2.2.1.16 (Test 2-1)  Clause 5.2.3.1.16 (Test 3-1, Test 4-1) | If the Test 2-2 in Clause 5.2.2.1.16 is passed, the test coverage can be considered fulfilled without executing Test 2-1 in clause 5.2.2.1.16.  If the Test 3-2 in Clause 5.2.3.1.16 is passed, the test coverage can be considered fulfilled without executing Test 3-1 in clause 5.2.3.1.16.  If the Test 4-2 in Clause 5.2.3.1.16 is passed, the test coverage can be considered fulfilled without executing Test 4-1 in clause 5.2.3.1.16. |
| FR1 TDD | PDSCH | Clause 5.2.2.2.17  (Test 2-1)  Clause 5.2.3.2.17  (Test 3-1, Test 4-1) | If the Test 2-2 in Clause 5.2.2.2.17 is passed, the test coverage can be considered fulfilled without executing Test 2-1 in clause 5.2.2.2.17.  If the Test 3-2 in Clause 5.2.3.2.17 is passed, the test coverage can be considered fulfilled without executing Test 3-1 in clause 5.2.3.2.17.  If the Test 4-2 in Clause 5.2.3.2.17 is passed, the test coverage can be considered fulfilled without executing Test 4-1 in clause 5.2.3.2.17. |
| Support for MU-MIMO Interference Mitigation advanced receiver (R-ML) receiver with enhanced inter-user interference suppression for MU-MIMO for 2 layers across target and co-scheduled UEs with 2RX and 4RX when the co-scheduled UE information with DCI index 6 or 7 in Table 7.3.1.2.2-12 of TS38.212 [10] is signalled. | FR1 FDD | PDSCH | Clause 5.2.2.1.16  (Test 2-2)  Clause 5.2.3.1.16  (Test 3-2) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.17  (Test 2-2)  Clause 5.2.3.2.17  (Test 3-2) |  |
| Support for MU-MIMO Interference Mitigation advanced receiver (R-ML) receiver with enhanced inter-user interference suppression for MU-MIMO for 2 layers across target and co-scheduled UEs with 2RX and maxNumberMIMO-LayersPDSCH layers across target and co-scheduled UEs with 4RX when the co-scheduled UE information with DCI index 6 in Table 7.3.1.2.2-12 of TS38.212 [10] is signalled. | FR1 FDD | PDSCH | Clause 5.2.2.1.16  (Test 2-2)  Clause 5.2.3.1.16  (Test 3-2, Test 4-2) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.17  (Test 2-2)  Clause 5.2.3.2.17  (Test 3-2, Test 4-2) |  |
|  |  |  |  |  |
|  |  |  |  |

#### 5.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 5.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 5.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE feature/capability [14] | Test type | | Test list | Applicability notes |
| 256QAM modulation scheme for PDSCH for FR1 (*pdsch-256QAM-FR1*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-3)  Clause 5.2.3.1.1 (Test 1-3) |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-3)  Clause 5.2.3.2.1 (Test 1-3) |  |
| PDSCH mapping type B (*pdsch-MappingTypeB*) | FR1 FDD | PDSCH | Clause 5.2.2.1.3  Clause 5.2.3.1.3  Clause 5.2.2.1.7  Clause 5.2.3.1.7 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.3  Clause 5.2.3.2.3  Clause 5.2.2.2.7  Clause 5.2.3.2.7 |  |
| Rate-matching around LTE CRS (*rateMatchingLTE-CRS*) | FR1 FDD | PDSCH | Clause 5.2.2.1.4  Clause 5.2.3.1.4 | For UEs supporting “Alternative additional DMRS position for co-existence with LTE CRS”, if Test 1-2 is tested, the test coverage can be considered fulfilled without executing Test 1-1. Otherwise, only Test 1-1 is tested. |
| FR1 TDD | PDSCH | Clause 5.2.2.2.4  Clause 5.2.3.2.4 |
| Supported maximum number of ports across all configured NZP-CSI-RS resources per CC (*maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC*) | FR1 FDD | PDSCH | Clause 5.2.2.1.4 (Tests 1-1, 1-2)  Clause 5.2.3.1.1 (Tests 3-1, 4-1, 5-1)  Clause 5.2.3.1.4 (Tests 1-1, 1-2)  Clause 5.2.3.1.16 (Test 3-1, 3-2, 4-1, 4-2) | The requirements apply only in case the number of NZP-CSI-RS ports in the test case satisfies UE capability on maximum number of NZP-CSI-RS ports |
|  | FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Test 3-1, 4-1, 5-1)  Clause 5.2.3.2.17 (Test 3-1, 3-2, 4-1, 4-2) |  |
| Supported maximum number of PDSCH MIMO layers (*maxNumberMIMO-LayersPDSCH*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Tests 2-1, 2-2, 3-1)  Clause 5.2.2.1.2  Clause 5.2.3.1.1 (Tests 2-1, 2-2, 3-1, 4-1, 5-1)  Clause 5.2.3.1.2 | The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Tests 2-1, 2-2, 3-1)  Clause 5.2.2.2.2  Clause 5.2.3.2.1 (Tests 2-1, 2-2, 3-1, 4-1, 5-1)  Clause 5.2.3.2.2 |  |
| Support number of active TCI states per BWP per CC, including control and data *(maxNumberActiveTCI-PerBWP)* | FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-2)  Clause 5.2.3.1.10 (Test 1-2) | The requirements apply only when *maxNumberActiveTCI-PerBWP* is other than n1. |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-2)  Clause 5.2.3.2.10 (Test 1-2) |  |
| Support for maximum number of TRS resource sets per CC which the UE can track simultaneously (*maxSimultaneousResourceSetsPerCC*) | FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-2)  Clause 5.2.3.1.10 (Test 1-2)  Clause 5.2.2.1.11  Clause 5.2.2.1.12  Clause 5.2.2.1.13  Clause 5.2.2.1.14  Clause 5.2.3.1.11  Clause 5.2.3.1.12  Clause 5.2.3.1.13  Clause 5.2.3.1.14 | The requirements apply only when *maxSimultaneousResourceSetsPerCC* ≥ 2 |
| FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-2)  Clause 5.2.3.2.10 (Test 1-2)  Clause 5.2.2.2.11  Clause 5.2.2.2.12  Clause 5.2.2.2.13  Clause 5.2.2.2.14  Clause 5.2.3.2.11  Clause 5.2.3.2.12  Clause 5.2.3.2.13  Clause 5.2.3.2.14 |

**<End of change R4-2409884>**

**<Start of change R4-2409885>**

##### 5.2.2.1.16 Minimum requirements for PDSCH with intra cell inter user interference

The performance requirements are specified in Table 5.2.2.1.16-3, with the addition of test parameters in Table 5.2.2.1.16-2 and the downlink physical channel setup according to Annex C.3.1.

The performance requirements for UE supporting Enhanced Receiver Type 2 are specified in Table 5.2.2.1.16-5, with the addition of test parameters in Tables 5.2.2.1.16-2, 5.2.2.1.16-4 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.16-1.

Table 5.2.2.1.16-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions when the PDSCH transmission of target UE is interfered by co-scheduled UE | 1-1 |
| Verify PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is explicitly signaled by DCI. | 2-1 |
| Verify PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is detected. | 2-2 |

Table 5.2.2.1.16-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | FDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 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 |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | 1000 | 1001 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 | 1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1. Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1 and 2-2 |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 4 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | N/A |
| Note 1: The DMRS scrambling ID is same for both target UE and Co-scheduled UE. | | | | |

Table 5.2.2.1.16-3: Minimum performance for target UE with 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 | |
| Target UE | Co-scheduled UE | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x2, ULA Low | 70 | 18.0 |

The parameters in Table 5.2.2.1.16-4 are configured for requirements with Enhanced Receiver Type 2.

Table 5.2.3.1.16-4: Assitance Information parameters for requirements with Enhanced Receiver Type 2

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| AdvancedReceiver-MU-MIMO-r18 | precodingAndResourceAllocation | True |
| pdsch-TimeDomainAllocation | True |
| mcs-Table | qam256 |
| advReceiver-MU-MIMO-DCI-1-1 | Enabled |
| Co-scheduled UE information in DCI (Table 7.3.1.2.2-12 of TS38.212) | | 1 for Test 2-1  6 for Test 2-2 |

Table 5.2.2.1.16-5: Minimum performance for target UE with Rank 1 with Enhanced Receiver Type 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random QPSK symbols | TDLC300-100 | 2x2, ULA Medium | 70 | [16.3] |
| 2-2 | R.PDSCH.5-1.3 FDD | 10 / 15 | 64QAM,  0.43 | Random 16QAM symbols | TDLC300-100 | 2x2, ULA Medium | 70 | [24.4] |

**<End of change R4-2409885>**

**<Start of change R4-2409883>**

##### 5.2.3.1.16 Minimum requirements for PDSCH with intra-cell inter-user interference

The performance requirements are specified in Table 5.2.3.1.16-3 and Table 5.2.3.1.16-4, with the addition of test parameters in Table 5.2.3.1.16-2 and the downlink physical channel setup according to Annex C.3.1.

The performance requirements for UE supporting Enhanced receiver Type 2 for intra-cell inter-user interference are specified in Table 5.2.3.1.16-6 and Table 5.2.3.1.16-7, with the addition of test parameters in Tables 5.2.3.1.16-2, 5.2.3.1.16-5 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.16-1.

Table 5.2.3.1.16-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE. | 1-1, 2-1 |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced receiver Type 2 when modulation order for co-scheduled UE is explicitly signaled by DCI. | 3-1, 4-1 |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced receiver Type 2 when modulation order for co-scheduled UE is detected. | 3-2, 4.2 |

Table 5.2.3.1.16-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | FDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 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 (Note 1) | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | {1000} for test 1-1, 3-1, 3-2  {1000, 1001} for test 2-1, 4-1, 4-2 | {1001} for test 1-1, 3-1, 3-2  {1002, 1003} for test 2-1, 4-1, 4-2 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 for test 1-1, 3-1, 3-2  2 for test 2-1, 4-1, 4-2 | 1 for test 1-1, 3-1, 3-2  2 for test 2-1, 4-1, 4-2 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].  Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1  Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1, 3-1, 3-2, 4-1, 4-2 |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 4 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | N/A |
| Note 1: DMRS scrambling ID is the same for both target and co-scheduled UEs. | | | | |

Table5.2.3.1.16-3: Minimum performance for target UE with 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 | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x4, ULA Low | 70 | 11.5 |

Table5.2.3.1.16-4: Minimum performance for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.5-1.2 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLA30-10 | 4x4, ULA Low | 70 | 15.3 |

The parameters in Table 5.2.3.1.16-5 are configured for requirements with Enhanced receiver Type 2 for intra-cell inter-user interference.

Table 5.2.3.1.16-5: Assitance Information parameters for requirements with Enhanced receiver Type 2

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| AdvancedReceiver-MU-MIMO-r18 | precodingAndResourceAllocation | True |
| pdsch-TimeDomainAllocation | True |
| mcs-Table | qam256 |
| advReceiver-MU-MIMO-DCI-1-1 | Enabled |
| Co-scheduled UE information in DCI (Table 7.3.1.2.2-12 of TS38.212) | | 1 for Test 3-1  2 for Test 4-1  6 for Test 3-2, 4-2 |

Table 5.2.3.1.16-6: Minimum performance for target UE with Rank 1 with Enhanced receiver Type 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 3-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random QPSK symbols | TDLC300-100 | 2x4, ULA Medium | 70 | [15.2] |
| 3-2 | R.PDSCH.5-1.3 FDD | 10 / 15 | 64QAM, 0.43 | Random 16QAM symbols | TDLC300-100 | 2x4, ULA Medium | 70 | [24.2] |

Table5.2.3.1.16-7: Minimum performance for target UE with Rank 2 with Enhanced receiver Type 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 4-1 | R.PDSCH.5-1.4 FDD | 10 / 15 | 64QAM, 0.43 | Random 16QAM symbols | TDLA30-10 | 4x4, ULA Low | 70 | [19.3] |
| 4-2 | R.PDSCH.5-1.2 FDD | 10 / 15 | 16QAM, 0.48 | Random QPSK symbols | TDLA30-10 | 4x4, ULA Low | 70 | [14.4] |

**<Start of change R4-2409883>**

**< Start of change R4-2409850>**

##### 5.2.2.2.17 Minimum requirements for PDSCH with intra cell inter user interference

The performance requirements are specified in Table 5.2.2.2.17-3, with the addition of test parameters in Table 5.2.2.2.17-2 and the downlink physical channel setup according to Annex C.3.1.

The performance requirements for UE supporting Enhanced Receiver Type 2 are specified in Table 5.2.2.2.17-5, with the addition of test parameters in Table 5.2.2.2.17-2 and Table 5.2.2.2.17-4, and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.17-1.

Table 5.2.2.2.17-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1 |
| Verify PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is explicitly signaled by DCI. | 2-1 |
| Verify PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is detected. | 2-2 |

Table 5.2.2.2.17-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | TDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 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 |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | 1000 | 1001 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 | 1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1.  Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1 and 2-2. |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 8 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | N/A |
| Note 1: The DMRS scrambling ID is same for both target UE and Co-scheduled UE. | | | | |

Table 5.2.2.2.17-3: Minimum performance for target UE with 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 UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 18.9 |

The parameters in Table 5.2.2.2.17-4 are configured for requirements with enhanced Receiver Type 2.

Table 5.2.2.2.17-4: Assistance Information parameters for requirements with Enhanced Receiver Type 2

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| AdvancedReceiver-MU-MIMO-r18 | precodingAndResourceAllocation | True |
| pdsch-TimeDomainAllocation | True |
| mcs-Table | qam256 |
| advReceiver-MU-MIMO-DCI-1-1 | Enabled |
| Co-scheduled UE information in DCI (Table 7.3.1.2.2-12 of TS38.212[10]) | | 1 for Test 2-1  6 for Test 2-2 |

Table 5.2.2.2.17-5: Minimum performance for target UE with Rank 1 with Enhanced Receiver Type 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random QPSK symbols | FR1.30-1 | TDLC300-100 | 2x2, ULA Medium | 70 | [16.6] |
| 2-2 | R.PDSCH.7-1.3 TDD | 40 / 30 | 64QAM,  0.43 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x2, ULA Medium | 70 | [26.0] |

**<End of change R4-2409950>**

**<Start of change R4-2409887>**

##### 5.2.3.2.17 Minimum requirements for PDSCH with intra-cell inter-user interference

The performance requirements are specified in Table 5.2.3.2.17-3 and and Table 5.2.3.2.17-4, with the addition of test parameters in Table 5.2.3.2.17-2 and the downlink physical channel setup according to Annex C.3.1.

The performance requirements for UE supporting Enhanced Receiver Type 2 are specified in Table 5.2.3.2.17-6 and Table 5.2.3.2.17-7, with the addition of test parameters in Tables 5.2.3.2.17-2, 5.2.3.2.17-5 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.17-1.

Table 5.2.3.2.17-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE. | 1-1, 2-1 |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is explicitly signaled by DCI. | 3-1, 4-1 |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE with Enhanced Receiver Type 2 when modulation order for co-scheduled UE is detected. | 3-2, 4-2 |

Table 5.2.3.2.17-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | TDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 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 (Note 1) | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | {1000} for tests 1-1, 3-1, 3-2  {1000, 1001} for tests 2-1, 4-1, 4-2 | {1001} for tests 1-1, 3-1, 3-2  {1002, 1003} for tests 2-1, 4-1, 4-2 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 for tests 1-1, 3-1, 3-2  2 for tests 2-1, 4-1, 4-2 | 1 for tests 1-1, 3-1, 3-2  2 for tests 2-1, 4-1, 4-2 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].  Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1  Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1, 3-1, 3-2, 4-1, 4-2 |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 8 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | N/A |
| Note 1: DMRS scrambling ID is the same for both target and co-shceduled UEs. | | | | |

Table5.2.3.1.17-3: Minimum performance for target UE with 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 UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | 11.8 |

Table 5.2.3.2.17-4: Minimum performance for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.7-1.2 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 15.5 |

The parameters in Table 5.2.3.2.17-5 are configured for requirements with Enhanced Receiver Type 2.

Table 5.2.3.2.17-5: Assistance Information parameters for requirements with Enhanced Receiver Type 2

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| AdvancedReceiver-MU-MIMO-r18 | precodingAndResourceAllocation | True |
| pdsch-TimeDomainAllocation | True |
| mcs-Table | qam256 |
| advReceiver-MU-MIMO-DCI-1-1 | Enabled |
| Co-scheduled UE information in DCI (Table 7.3.1.2.2-12 of TS38.212) | | 1 for Test 3-1  2 for Test 4-1  6 for Test 3-2, 4-2 |

Table 5.2.3.2.17-6: Minimum performance for target UE with Rank 1 with Enhanced Receiver Type 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 3-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random QPSK symbols | FR1.30-1 | TDLC300-100 | 2x4, ULA Medium | 70 | [15.5] |
| 3-2 | R.PDSCH.7-1.3 TDD | 40 / 30 | 64QAM, 0.43 | Random 16-QAM symbols | FR1.30-1 | TDLC300-100 | 2x4, ULA Medium | 70 | [25.3] |

Table 5.2.3.2.17-7: Minimum performance for target UE with Rank 2 with Enhanced Receiver Type 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 4-1 | R.PDSCH.7-1.4 TDD | 40 / 30 | 64QAM, 0.43 | Random 16QAM symbols | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | [19.5] |
| 4-2 | R.PDSCH.7-1.2 TDD | 40 / 30 | 16QAM, 0.48 | Random QPSK symbols | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | [14.9] |

**<End of change R4-2409887>**

**<Start of change R4-2409968>**

#### A.3.2.1.5 Reference measurement channels for Intra-cell Inter-UE interference scenario

Table A.3.2.1.5-1: PDSCH Reference Channel for FDD Intra-cell Inter-UE interference scenario

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | |
| Reference channel |  | R.PDSCH.5-1.1 FDD | R.PDSCH.5-1.2 FDD | R.PDSCH.5-1.3 FDD | R.PDSCH.5-1.4 FDD |  |
| Channel bandwidth | MHz | 10 | 10 | 10 | 10 |  |
| Subcarrier spacing | kHz | 15 | 15 | 15 | 15 |  |
| Number of allocated resource blocks | PRBs | 52 | 52 | 52 | 52 |  |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 |  |
| Allocated slots per 2 frames | Slots | 19 | 19 | 19 | 19 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM |  |
| MCS index |  | 13 | 13 | 17 | 17 |  |
| Modulation |  | 16QAM | 16QAM | 64QAM | 64QAM |  |
| Target Coding Rate |  | 0.48 | 0.48 | 0.43 | 0.43 |  |
| Number of MIMO layers |  | 1 | 2 | 1 | 2 |  |
| Number of DMRS REs |  | 12 | 24 | 12 | 24 |  |
| 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 | 13064 | 24072 | 17928 | 32264 |  |
| 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 | 24 | 24 | 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 | 2 | 3 | 3 | 4 |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slot i = 0 | Bits | N/A | N/A | N/A | N/A |  |
| For Slots i = 10, 11 | Bits | 26208 | 47424 | 39312 | 71136 |  |
| For Slots i = 1,…, 9, 12, …, 19 | Bits | 27456 | 49920 | 41184 | 74880 |  |
| Max. Throughput averaged over 2 frames | Mbps | 12.411 | 22.868 | 34.960 | 62.915 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | |

**<< Unchanged sections omitted >>**

#### A.3.2.2.7 Reference measurement channels for Intra-cell Inter-UE interference scenario

Table A.3.2.2.7-1: PDSCH Reference Channel for TDD Intra-cell Inter-UE interference scenario

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | Unit | Value | | | | |
| Reference channel |  | R.PDSCH.7-1.1 TDD | R.PDSCH.7-1.2 TDD | R.PDSCH.7-1.3 TDD | R.PDSCH.7-1.4 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 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 | 17 | 17 |  |
| Modulation |  | 16QAM | 16QAM | 64QAM | 64QAM |  |
| Target Coding Rate |  | 0.48 | 0.48 | 0.43 | 0.43 |  |
| Number of MIMO layers |  | 1 | 2 | 1 | 2 |  |
| Number of DMRS REs |  |  |  |  |  |  |
| For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |  | 6 | 12 | 6 | 12 |  |
| For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} |  | 12 | 24 | 12 | 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 | 14600 | 11528 | 19464 |  |
| For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | Bits | 26632 | 49176 | 35856 | 65576 |  |
| 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 | 2 | 2 | 3 |  |
| For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,39} | CBs | 4 | 6 | 5 | 8 |  |
| 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 | 96672 | 80136 | 160272 |  |
| For Slot i, if mod(i, 10) = 7 for i from {0,…,39} | Bits | 17808 | 30528 | 26712 | 53424 |  |
| For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 55968 | 101760 | 83952 | 167904 |  |
| Max. Throughput averaged over 2 frames | Mbps | 37.644 | 69.308 | 57.755 | 104.817 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames | | | | | | |

**<End of change R4-2409968>**