**3GPP TSG- Meeting #**

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

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| ***Title:*** |  | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **D** |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories 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:*** | | Tables containing PDCCH test cases do not follow the test numbering used for PDSCH and PBCH, where a prefix is added following the number of tables in the subclause. This is, for example, “Table 5.3.2.1.2-1, Test 1” vs “Table 5.3.2.1.2-1, Test 2-1” | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Adding prefix to PDCCH test case number in the tables where they are defined. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Format would remain inconsistent with the rest of the specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.1.1.3, 5.3.1.1.1, 5.3.1.2.1, 5.3.2.1.1, 5.3.2.1.2, 5.3.2.1.3, 5.3.2.1.4, 5.3.2.1.5, 5.3.2.2.1, 5.3.2.2.2, 5.3.2.2.3, 5.3.2.2.4, 5.3.2.2.5, 5.3.3.1.1, 5.3.3.1.2, 5.3.3.1.3, 5.3.3.1.4, 5.3.3.2.1, 5.3.3.2.2, 5.3.3.2.3, 5.3.3.2.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.521-4 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Revision of R4-2818599 | | | | | | | | |

----------------------------------------------------- Beginning of Change ------------------------------------------------------------

### 5.1.1 Applicability of requirements

#### 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) |  | |
| Alternative additional DMRS position for co-existence with LTE CRS *(additionalDMRS-DL-Alt)* | FR1 FDD | PDSCH | Clause 5.2.2.1.4 (Test 1-2)  Clause 5.2.3.1.4 (Test 1-2) |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.4 (Test 1-2)  Clause 5.2.3.2.4 (Test 1-2) |  | |
| Basic DL NR-NR CA operation (*supportedBandCombinationList*) | NR CA | SDR | Clause 5.5A.1 | 1)Up to 16 DL carriers  2)Same numerology across carrier for data/control channel at a given time | |
| Enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500km/h | FR1 FDD | PDSCH | Clause 5.2.2.1.9 (Test 1-1)  Clause 5.2.3.1.9 (Test 1-1) |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.9 (Test 1-1)  Clause 5.2.3.2.9 (Test 1-1) |  | |
| Alternative 64QAM MCS table for PDSCHNew 64QAM MCS table for PDSCH (*dl-64QAM-MCS-TableAlt*) | FR1 FDD | PDSCH | Clause 5.2.2.1.5  Clause 5.2.3.1.5  Clause 5.2.2.1.6  Clause 5.2.3.1.6 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.5  Clause 5.2.3.2.5  Clause 5.2.2.2.6  Clause 5.2.3.2.6 |  | |
| CQI table with target BLER of 10^-5New CQI table (cqi-TableAlt) | FR1 FDD | PDSCH | Clause 5.2.2.1.5  Clause 5.2.3.1.5 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.5  Clause 5.2.3.2.5 |  | |
| PDSCH repetitions over multiple slots *(pdsch-RepetitionMultiSlots)* | FR1 FDD | PDSCH | Clause 5.2.2.1.6  Clause 5.2.3.1.6 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.6  Clause 5.2.3.2.6 |  | |
| UE PDSCH processing capability #2 *(pdsch-ProcessingType2)* | FR1 FDD | PDSCH | Clause 5.2.2.1.7  Clause 5.2.3.1.7 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.7  Clause 5.2.3.2.7 |  | |
| Pre-emption indication for DL *(pre-EmptIndication-DL)* | FR1 FDD | PDSCH | Clause 5.2.2.1.8  Clause 5.2.3.1.8 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.8  Clause 5.2.3.2.8 |  | |
| Single DCI based SDM transmission for multi-TRxP (singleDCI-SDM-scheme-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.11  Clause 5.2.3.1.11 |  | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.11  Clause 5.2.3.2.11 |  | |
| Multi DCI based multi-TRxP support (multiDCI-MultiTRP-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.12  Clause 5.2.3.1.12 |  | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.12  Clause 5.2.3.2.12 |  | |
| Single DCI based FDM Scheme-A for multi-TRxP(supportFDM-SchemeA-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.13  Clause 5.2.3.1.13 |  | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.13  Clause 5.2.3.2.13 |  | |
| Single DCI based inter-slot TDM for multi-TRxP (supportInter-slotTDM-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.14  Clause 5.2.3.1.14 |  | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.14  Clause 5.2.3.2.14 |  | |
| Maximum number of TCI states in Single-DCI based inter-slot TDM (maxNumberTCI-states-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.14  Clause 5.2.3.1.14 | | The requirements apply only when maxNumberTCI-states-r16 = 2. | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.14  Clause 5.2.3.2.14 | |
| DRX Adaptation (*drx-Adaptation-r16*) | FR1 FDD | PDCCH | Clause 5.3.2.1.3 | If the Test 1-1 in Clause 5.3.2.1.3 is passed, the test coverage can be considered fulfilled without executing Test 1-3 in clause 5.3.2.1.1. | |
| FR1 TDD | PDCCH | Clause 5.3.2.2.3 | If the Test 1-1 in Clause 5.3.2.2.3 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.3.2.2.1. | |
| FR1 FDD | PDCCH | Clause 5.3.3.1.3 | If the Test 1-1 in Clause 5.3.3.1.3 is passed, the test coverage can be considered fulfilled without executing Test 1-3 in clause 5.3.3.1.1. | |
| FR1 TDD | PDCCH | Clause 5.3.3.2.3 | If the Test 1-1 in Clause 5.3.3.2.3 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.3.3.2.1. | |
| Validating P/SP-CSI-RS reception (*periodicAndSemi-PersistentCSI-RS-r16*) | FR1 TDD | PDSCH | Clause 5.2.2.2.15  Clause 5.2.3.2.15  Clause 5.2A.2.3  Clause 5.2A.3.3 | The requirements apply only in case tested UE supporting operations in shared spectrum access and validation of P/SP-CSI-RS reception based on DCI | |
| Supported UL channels for dynamic channel access mode (*ul-DynamicChAccess-r16*) or UL channel access for semi-static channel access mode (ul-Semi-StaticChAccess-r16) or both | FR1 TDD | PDSCH | Clause 5.2.2.2.15  Clause 5.2.3.2.15 | The requirements apply only in case tested UE supports one of UL channels for dynamic channel access mode and UL channel access for semi-static channel access mode | |
| 1024QAM modulation for PDSCH for FR1 (*pdsch-1024QAM-FR1-r17* or *pdsch-1024QAM-2MIMO-FR1-r17*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-8)  Clause 5.2.3.1.1 (Test 1-8) |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-12)  Clause 5.2.3.2.1 (Test 1-12) |  | |
|  |  | SDR | Clause 5.5.1  Clause 5.5A.1 | 1024QAM MCS indexes are used only if UE supports 1024QAM for FR1 DL. | |
| Support of neighboring LTE cell CRS-IM in DSS scenario with NR 15 kHz SCS ( *CRS-IM-DSS-15kHzSCS-r17*) | FR1 FDD | PDSCH | Clause 5.2.2.1.18  Clause 5.2.3.1.17 | UE can support the feature on the CC(s) in a band only if the UE indicates support of rateMatchingLTE-CRS on that band. | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.19  Clause 5.2.3.2.18 |
| Support of neighboring LTE cell CRS-IM in non-DSS and 15 kHz NR SCS scenario, without the assistance of network signaling on LTE channel bandwidth (*CRS-IM-nonDSS-15kHzSCS-r17*) | FR1 FDD | PDSCH | Clause 5.2.2.1.19 (Test 2-1)  Clause 5.2.3.1.18 (Test 2-1) | The UE can perform CRS-IM when MeasObjectEUTRA IE is configured, and the configured measurement gaps overlap with neighbour LTE cell PBCH position. | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 2-1)  Clause 5.2.3.2.19 (Test 2-1) |
| Support of neighboring LTE cell CRS-IM in non-DSS and 15 kHz NR SCS scenario, with the assistance of network signaling on LTE channel bandwidth (*CRS-IM-nonDSS-NWA-15kHzSCS-r17*) | FR1 FDD | PDSCH | Clause 5.2.2.1.19 (Test 1-1)  Clause 5.2.3.1.18 (Test 1-1) | If the Test 2-1 in Clause 5.2.2.1.19 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.2.1.19.  If the Test 2-1 in Clause 5.2.3.1.18 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.3.1.18. | |
| FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 1-1)  Clause 5.2.3.2.19 (Test 1-1) | If the Test 2-1 in Clause 5.2.2.2.20 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.2.2.20.  If the Test 2-1 in Clause 5.2.3.2.19 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.3.2.19. | |
| CRS-IM in non-DSS and 30 kHz NR SCS scenario, without the assistance of network signaling on LTE channel bandwidth (*crs-IM-nonDSS-30kHzSCS-r17*) | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 2-2)  Clause 5.2.3.2.19 (Test 2-2) | The UE can perform CRS-IM when MeasObjectEUTRA IE is configured, and the configured measurement gaps overlap with neighbour LTE cell PBCH position. | |
| CRS-IM in non-DSS and 30 kHz NR SCS scenario, with the assistance of network signaling on LTE channel bandwidth (crs*-IM-nonDSS-NWA-30kHzSCS-r17*) | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 1-2)  Clause 5.2.3.2.19 (Test 1-2) | If the Test 2-2 in Clause 5.2.2.2.20 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.2.2.2.20.  If the Test 2-2 in Clause 5.2.3.2.19 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.2.3.2.19. | |
| Support for SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH *(sfn-SchemeA-r17)* | FR1 FDD | PDSCH | Clause 5.2.2.1.20  Clause 5.2.3.1.19 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.21  Clause 5.2.3.2.20 |  | |
| Support for SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH *(sfn-SchemeB-r17)* | FR1 FDD | PDSCH | Clause 5.2.2.1.21  Clause 5.2.3.1.20 |  | |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.22  Clause 5.2.3.2.21 |  | |
| 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 |  | |

------------------------------------------------------------- End of change ------------------------------------------------------------

----------------------------------------------------- Beginning of Change ------------------------------------------------------------

## 5.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 5.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 5.3-1: Common test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | |  | 0 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Number of PDCCH candidates | |  | 1 |
| Frequency domain resource allocation for CORESET | |  | Start from RB = 0 with contiguous RB allocation |
| TCI state | |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8 |
| Number of CSI-RS ports (*X*) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (*ρ*) | |  | 3 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size /4)\*4 |
| QCL info | |  | TCI state #0 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PDCCH & PDCCH DMRS Precoding configuration | | |  | For number of TX = 1: No precoding;  For number of TX > 1: Single Panel Type I, Randomized precoder selection for every REG 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]. |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 for FDD  For TDD, specific to each TDD UL-DL pattern and as defined in Annex A.1.2. |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.  Note 2: The high layer parameter *precoderGranularity* equals to *sameAsREG-bundle* as defined in clause 7.4.1.3 of TS 38.211 [9]. | | | | |

### 5.3.1 1RX requirements

#### 5.3.1.1 FDD

The parameters specified in Table 5.3.1.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit |  |
| CCE to REG mapping type |  | nonInterleaved |
| REG bundle size |  | 6 |
| Shift index |  | 0 |

##### 5.3.1.1.1 Minimum requirements for RedCap

For the parameters specified in Table 5.3.1.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.1.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.1.1.1-1: Minimum performance for UE supporting full-duplex FDD or half-duplex FDD

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x1 Low | 1 | 5.8 |

#### 5.3.1.2 TDD

The parameters specified in Table 5.3.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.1.2-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit |  |
| TDD UL-DL pattern |  | FR1.30-1 |
| CCE to REG mapping type |  | interleaved |
| Interleaver size |  | 3 |
| REG bundle size |  | 2 |
| Shift Index |  | 0 |

##### 5.3.1.2.1 Minimum requirements for RedCap

For the parameters specified in Table 5.3.1.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.1.2.1-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 20 | 48 | 1 | 4 | R.PDCCH. 2-1.5 TDD | TDLC300-100 | 1x1 | 1 | 8.6 |

### 5.3.2 2RX requirements

#### 5.3.2.1 FDD

The parameters specified in Table 5.3.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.2.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **1 Tx Antenna** | **2 Tx Antenna** |
| CCE to REG mapping type |  | nonInterleaved | |
| REG bundle size |  | 6 | |
| Shift index |  | 0 | |

##### 5.3.2.1.1 Minimum requirements with 1TX antenna

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.1-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 1x2 Low | 1 | 8.1 |
| 1-2 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.3 FDD | TDLC300-100 | 1x2 Low | 1 | 8.2 |
| 1-3 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 1-4 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x2 Low | 1 | 4.4 |
| 1-5 | 10 | 48 | 2 | 16 | R.PDCCH. 1-2.6 FDD | TDLA30-10 | 1x2 Low | 1 | -2.1 |

##### 5.3.2.1.2 Minimum requirements with 2TX antenna

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.2-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 10 | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x2 Low | 1 | 2.0 |
| 1-2 | 10 | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x2 Low | 1 | -1.3 |
| 1-3 | 10 | 48 | 1 | 8 | R.PDCCH.1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | -0.2 |

##### 5.3.2.1.3 Minimum requirements for power saving

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.2.1.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.2.1.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| CCE to REG mapping type | |  | nonInterleaved |
| REG bundle size | |  | 6 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  |  |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
|  | |  |  |
| Note: TminimumTimeGap­ is signaled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 5.3.2.1.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.1.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.3-2: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

##### 5.3.2.1.4 Minimum requirements for RedCap

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.4-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.4-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 1-2 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | -0.2 |

##### 5.3.2.1.5 Minimum requirements for PDCCH with intra-slot repetition

The performance requirements are specified in Table 5.3.2.1.5-2, with the addition of test parameters in Table 5.3.2.1.5-1. The downlink physical channel setup according to Annex C.3.1.

Table 5.3.2.1.5-1: Tests parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.5us, frequency offset = 200Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

Table 5.3.2.1.5-2: Minimum performance for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1-1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x2, ULA Low | 1 | 2.7 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

#### 5.3.2.2 TDD

The parameters specified in Table 5.3.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.2.2-1: Test Parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **1 Tx Antenna** | | | **2 Tx Antenna** |
| TDD UL-DL pattern |  | FR1.30-1 | | | |
| CCE to REG mapping type |  | Test 3: non-interleaved  Other tests: interleaved | | interleaved | |
| Interleaver size |  | 3 | | | |
| REG bundle size |  | Test 3: 6  Other tests: 2 | est 1 in Table 5.3.2.2.2-1: 6  Other tests: 2 | | |
| Shift Index |  | 0 | | | |

##### 5.3.2.2.1 Minimum requirements with 1TX antenna

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.1-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 40 | 102 | 1 | 2 | R.PDCCH. 2-1.1 TDD | TDLA30-10 | 1x2 Low | 1 | 7.0 |
| 1-2 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.0 |
| 1-3 | 40 | 48 | 2 | 16 | R.PDCCH. 2-2.1 TDD | TDLC300- 100 | 1x2 Low | 1 | -3.8 |

##### 5.3.2.2.2 Minimum requirements with 2TX antenna

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.2-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 40 | 90 | 1 | 8 | R.PDCCH. 2-1.3 TDD | TDLC300-100 | 2x2 Low | 1 | -1.2 |

##### 5.3.2.2.3 Minimum requirements for power saving

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.2.2.3-1 are valid for all TDD tests for power saving unless otherwise stated.

Table 5.3.2.2.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| TDD UL-DL pattern | |  | FR1.30-1 |
| CCE to REG mapping type | |  | interleaved |
| Interleaver size | |  | 3 |
| REG bundle size | |  | 2 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  | (TminimumTimeGap+1)//0.125 |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
| Note: TminimumTimeGap­ is signaled as a part of *drx-Adaptation-r16*UE capability | | | |

For the parameters specified in Table 5.3.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.3-2: Minimum performance with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.0 |
| 8 | R.PDCCH. 2-1.4 TDD |

##### 5.3.2.2.4 Minimum requirements for RedCap

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.4-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.4-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 20 | 48 | 1 | 4 | R.PDCCH. 2-1.5 TDD | TDLC300-100 | 1x2 Low | 1 | 3.6 |
| 1-2 | 20 | 48 | 1 | 8 | R.PDCCH. 2-1.6 TDD | TDLC300- 100 | 2x2 Low | 1 | 0.0 |

##### 5.3.2.2.5 Minimum requirements for PDCCH with intra-slot repetition

The performance requirements are specified in Table 5.3.2.2.5-2, with the addition of test parameters in Table 5.3.2.2.5-1. The downlink physical channel setup according to Annex C.3.1.

Table 5.3.2.2.5-1: Tests parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.25us, frequency offset = 300Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

Table 5.3.2.2.5-2: Minimum performance for PDCCH with 30kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1-1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x2, ULA Low | 1 | 3.5 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

### 5.3.3 4RX requirements

#### 5.3.3.1 FDD

The parameters specified in Table 5.3.3.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.3.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **1 Tx Antenna** | **2 Tx Antenna** |
| CCE to REG mapping type |  | nonInterleaved | |
| REG bundle size |  | 6 | |
| Shift index |  | 0 | |

##### 5.3.3.1.1 Minimum requirements with 1TX antenna

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.1-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 1x4 Low | 1 | 2.2 |
| 1-2 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.3 FDD | TDLC300- 100 | 1x4 Low | 1 | 2.7 |
| 1-3 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 0.2 |
| 1-4 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x4 Low | 1 | -0.4 |
| 1-5 | 10 | 48 | 2 | 16 | R.PDCCH. 1-2.6 FDD | TDLA30-10 | 1x4 Medium A | 1 | -3.2 |

##### 5.3.3.1.2 Minimum requirements with 2TX antenna

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.2-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 10 | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x4 Low | 1 | -1.9 |
| 1-2 | 10 | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x4 Low | 1 | -4.5 |
| 1-3 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.2 FDD | TDLA30-10 | 2x4 Low | 1 | -1.0 |

##### 5.3.3.1.3 Minimum requirements for power saving

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.3.1.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.3.1.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| CCE to REG mapping type | |  | nonInterleaved |
| REG bundle size | |  | 6 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  |  |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| Slots for PDCCH monitoring | |  | Each slot during DRX-on period |
| Note: TminimumTimeGap­ is signaled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 5.3.3.1.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.3.1.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.3-2: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 0.2 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

##### 5.3.3.1.4 Minimum requirements for PDCCH with intra-slot repetition

The performance requirements are specified in Table 5.3.3.1.4-2, with the addition of test parameters in Table 5.3.3.1.4-1. The downlink physical channel setup according to Annex C.3.1.

Table 5.3.3.1.4-1: Tests parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.5us, frequency offset = 200Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

Table 5.3.3.1.4-2: Minimum performance for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1-1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x4, ULA Low | 1 | -1.2 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

#### 5.3.3.2 TDD

The parameters specified in Table 5.3.3.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.3.2-1: Common Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **1 Tx Antenna** | | **2 Tx Antenna** |
| TDD UL-DL pattern |  | FR1.30-1 | | |
| CCE to REG mapping type |  | Test 3: Non-interleaved  Other tests: interleaved | interleaved | |
| Interleaver size |  | 3 | | |
| REG bundle size |  | Test 3: 6  Other tests: 2 | 6 | |
| Shift Index |  | 0 | | |

##### 5.3.3.2.1 Minimum requirements with 1TX antenna

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.1-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 40 | 102 | 1 | 2 | R.PDCCH. 2-1.1 TDD | TDLA30-10 | 1x4 Low | 1 | 2.1 |
| 1-2 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300-100 | 1x4 Low | 1 | -0.9 |
| 1-3 | 40 | 48 | 2 | 16 | R.PDCCH. 2-2.1 TDD | TDLA30-10 | 1x4 Medium A | 1 | -3.6 |

##### 5.3.3.2.2 Minimum requirements with 2TX antenna

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.2-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNR (dB)** |
| 1-1 | 40 | 90 | 1 | 8 | R.PDCCH. 2-1.3 TDD | TDLC300-100 | 2x4 Low | 1 | -4.3 |

##### 5.3.3.2.3 Minimum requirements for power saving

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

For the parameters specified in Table 5.3.3.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.3.2.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| TDD UL-DL pattern | |  | FR1.30-1 |
| CCE to REG mapping type | |  | interleaved |
| Interleaver size | |  | 3 |
| REG bundle size | |  | 2 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  | (TminimumTimeGap+1)//0.125 |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| Slots for PDCCH monitoring | |  | Each slot during DRX-on period |
| Note: TminimumTimeGap­ is signaled as a part of *drx-Adaptation-r16*UE capability. | | | |

Table 5.3.3.2.3-2: Minimum performance with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1-1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x4 Low | 1 | -0.9 |
| 8 | R.PDCCH. 2-1.4 TDD |

##### 5.3.3.2.4 Minimum requirements for PDCCH with intra-slot repetition

The performance requirements are specified in Table 5.3.3.2.4-2, with the addition of test parameters in Table 5.3.3.2.4-1. The downlink physical channel setup according to Annex C.3.1.

Table 5.3.3.2.4-1: Tests parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.25us, frequency offset = 300Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

Table 5.3.3.2.4-2: Minimum performance for PDCCH with 30kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix (Note 2) | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1-1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x4, ULA Low | 1 | -1.0 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

------------------------------------------------------------- End of change ------------------------------------------------------------