# 8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

Note: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

## 8.1 General

### 8.1.1 Dual-antenna receiver capability

The performance requirements are based on UE(s) that utilize a dual-antenna receiver.

For all test cases, the SNR is defined as



where the superscript indicates the receiver antenna connector. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

Table 8.1.1-1: Void

#### 8.1.1.1 Simultaneous unicast and MBMS operations

#### 8.1.1.2 Dual-antenna receiver capability in idle mode

### 8.1.2 Applicability of requirements

#### 8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

#### 8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1.

Table 8.1.2.2-1: Definition of CA capability with 2DL CCs

|  |  |
| --- | --- |
| CA Capability | CA Capability Description |
| CA2\_C | Intra-band contiguous CA |
| CA2\_A2 | Inter-band CA |
| Note 1: CA2\_C corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-1 for 2 DL CCs. CA2\_A2 corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-2 for 2 DL CCs. | |

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

|  |  |  |
| --- | --- | --- |
| CA Capability | Bandwidth combination for FDD CA | Bandwidth combination for TDD CA |
| CA2\_C | 20+20MHz | 20+20MHz |
| CA2\_A2 | 10+10MHz | NA |
| Note 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2. | | |

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers.

#### 8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3-1: Applicability and test rules for CA UE demodulation tests with 2 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Tests | CA capability where the tests apply | CA configuration from the selected CA capbility where the tests apply | CA Bandwidth combination to be tested in priority order |
| CA tests with 2CCs in Clause 8.2.1.1.1, 8.2.1.4.3 | Any one of the supported CA capabilities | Any one of the supported FDD CA configurations | 10+10 MHz, 20+20MHz |
| CA tests with 2CCs in Clause 8.2.1.3.1 | Each supported CA capability | Any one of the supported FDD CA configurations in each CA capability | 10+10 MHz, 20+20 MHz |
| CA tests with 2CCs in Clause 8.2.1.3.1A, 8.7.1 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.1.7.1 | CA\_C | Supported FDD intra-band contiguous CA configurations covering the lowest and highest operating bands | Largest aggregated CA bandwidth combinations |
| CA tests with 2CCs in Clause 8.2.2.1.1, 8.2.2.4.3 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.2.3.1 | Each supported CA capability | Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.2.3.1A, 8.7.2 | Any one of the supported CA capabilities with largest aggregated CA bandwidth | Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in 8.2.2.7.1 | CA\_C | Supported TDD intra-band contiguous CA configurations  covering the lowest and highest operating bands | Largest aggregated CA bandwidth combinations |
| Note 1: The applicability and test rules are specified in this table, unless otherwise stated.  Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is one. | | | |

#### 8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

## 8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

### 8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.2.1-1: Common Test Parameters (FDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Inter-TTI Distance | | |  | 1 | |
| Number of HARQ processes per component carrier | | | Processes | 8 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,1,2,3} for QPSK and 16QAM  {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbols | 4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths,  2 for 10 MHz, 15 MHz and 20 MHz bandwidths | |
| Cyclic Prefix | | |  | Normal | |
| Cell\_ID | | |  | 0 | |
| Cross carrier scheduling | | |  | Not configured | |

#### 8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

##### 8.2.1.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.1.1-1: Test Parameters

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Reference channel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  throughput (%) | SNR (dB) |
| 1 | 2x10 MHz | R.2 FDD | OP.1 FDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.1 | 3-8  (Note 2) |
| 2 | 2x20 MHz | R.42 FDD | OP.1 FDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.3 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.  Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1- 5 | Test 6- 8 | Test 9- 15 | Test 16- 18 | Test 19 |
| Downlink power allocation |  | dB | 0 | 0 | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | 0 | 0 | 0 | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) |
| Modulation | |  | QPSK | 16QAM | 64QAM | 16QAM | QPSK |
| PDSCH transmission mode | |  | 1 | 1 | 1 | 1 | 1 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 3: Void.  Note 4: Void. | | | | | | | |

Table 8.2.1.1.1-2: Minimum performance (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Referencechannel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 | 1-8 |
| 2 | 10 MHz | R.2 FDD | OP.1 FDD | ETU70 | 1x2 Low | 70 | -0.4 | 1-8 |
| 3 | 10 MHz | R.2 FDD | OP.1 FDD | ETU300 | 1x2 Low | 70 | 0.0 | 1-8 |
| 4 | 10 MHz | R.2 FDD | OP.1 FDD | HST | 1x2 | 70 | -2.4 | 1-8 |
| 5 | 1.4 MHz | R.4 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 0.0 | 1-8 |
| 6 | 10 MHz | R.3 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 6.7 | 2-8 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 6.7 | 1 |
| 7 | 10 MHz | R.3 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.4 | 2-8 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.4 | 1 |
| 8 | 10 MHz | R.3 FDD | OP.1 FDD | ETU300 | 1x2 High | 70 | 9.4 | 2-8 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | ETU300 | 1x2 High | 70 | 9.4 | 1 |
| 9 | 3 MHz | R.5 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.6 | 1-8 |
| 10 | 5 MHz | R.6 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.4 | 2-8 |
| 5 MHz | R.6-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.5 | 1 |
| 11 | 10 MHz | R.7 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.7 | 2-8 |
| 10 MHz | R.7-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 16.7 | 1 |
| 12 | 10 MHz | R.7 FDD | OP.1 FDD | ETU70 | 1x2 Low | 70 | 19.0 | 2-8 |
| 10 MHz | R.7-1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 70 | 18.1 | 1 |
| 13 | 10 MHz | R.7 FDD | OP.1 FDD | EVA5 | 1x2 High | 70 | 19.1 | 2-8 |
| 10 MHz | R.7-1 FDD | OP.1 FDD | EVA5 | 1x2 High | 70 | 17.8 | 1 |
| 14 | 15 MHz | R.8 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.7 | 2-8 |
| 15 MHz | R.8-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 16.8 | 1 |
| 15 | 20 MHz | R.9 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.6 | 3-8 |
| 20 MHz | R.9-2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.3 | 2 |
| 20 MHz | R.9-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 16.7 | 1 |
| 16 | 3 MHz | R.0 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.9 | 1-8 |
| 17 | 10 MHz | R.1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.9 | 1-8 |
| 18 | 20 MHz | R.1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.9 | 1-8 |
| 19 | 10 MHz | R.41 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -5.4 | 1-8 |
| Note 1: Void.  Note 2: Void.  Note 3: Void. | | | | | | | | |

Table 8.2.1.1.1-3: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-2 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) |
| Modulation | |  | QPSK |
| PDSCH transmission mode | |  | 1 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 3: PUCCH format 1b with channel selection is used to feedback ACK/NACK.  Note 4: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Reference channel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  throughput (%) | SNR (dB) |
| 1 | 2x10 MHz | R.2 FDD | OP.1 FDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.1 | 3-8  (Note 2) |
| 2 | 2x20 MHz | R.42 FDD | OP.1 FDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.3 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.  Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

##### 8.2.1.1.2 Void

##### 8.2.1.1.3 Void

##### 8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.1.1.4-1: Test Parameters for Testing 1 PRB allocation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1 | |
| Downlink power allocation | |  | | dB | | 0 | |
|  | | dB | | 0 (Note 1) | |
| σ | | dB | | 0 | |
| at antenna port | | | | dBm/15kHz | | -98 |
| Symbols for MBSFN portion of MBSFN subframes (Note 2) | | | |  | | OCNG (Note 3) |
| PDSCH transmission mode | | | |  | | 1 |
| Note 1:  Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the first slot.  Note 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes, QPSK modulated MBSFN data is used instead. | | | | | | |

Table 8.2.1.1.4-2: Minimum performance 1PRB (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.29 FDD | OP.3 FDD | ETU70 | 1x2 Low | 30 | 2.0 | 1-8 |

#### 8.2.1.2 Transmit diversity performance

##### 8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1-2 | |
| Downlink power allocation | |  | | dB | | -3 |
|  | | dB | | -3 (Note 1) |
| σ | | dB | | 0 |
| at antenna port | | | | dBm/15kHz | | -98 |
| PDSCH transmission mode | | | |  | | 2 |
| Note 1: . | | | | | | |

Table 8.2.1.2.1-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11 FDD | OP.1 FDD | EVA5 | 2x2 Medium | 70 | 6.8 | 2-8 |
| 5 MHz | R.11-2 FDD | OP.1 FDD | EVA5 | 2x2 Medium | 70 | 5.9 | 1 |
| 2 | 10 MHz | R.10 FDD | OP.1 FDD | HST | 2x2 | 70 | -2.3 | 1-8 |

##### 8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.1.2.2-1: Test Parameters for Transmit diversity Performance (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1-2 | |
| Downlink power allocation | |  | | dB | | -3 |
|  | | dB | | -3 (Note 1) |
| σ | | dB | | 0 |
| at antenna port | | | | dBm/15kHz | | -98 |
| PDSCH transmission mode | | | |  | | 2 |
| Note 1: . | | | | | | |

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 1.4 MHz | R.12 FDD | OP.1 FDD | EPA5 | 4x2 Medium | 70 | 0.6 | 1-8 |
| 2 | 10 MHz | R.13 FDD | OP.1 FDD | ETU70 | 4x2 Low | 70 | -0.9 | 1-8 |

##### 8.2.1.2.3 Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 | |
| σ | dB | | 0 | | N/A | |
| at antenna port | |  | dBm/15kHz | | -102 (Note 2) | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | |
|  | dBm/15kHz | | -94.8 (Note 4) | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.1.2.3-2 | | 6 | |
| BWChannel | | | MHz | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | 2.5 (synchronous cells) | | | |
| Cell Id | | |  | | 0 | | 1 | |
| ABS pattern (Note 5) | | |  | | N/A | | 11000100 11000000 11000000 11000000 11000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 11000100 11000000 11000000 11000000 11000000 | | N/A | |
| CCSI,1 |  | | 00111011 00111111 00111111 00111111 00111111 | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | 2 | |
| PDSCH transmission mode | | |  | | 2 | | N/A | |
| Cyclic prefix | | |  | | Normal | | Normal | |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 5: ABS pattern as defined in [9].  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test. | | | | | | | | |

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |  |
| 1 | R.11-4 FDD (Note 4) | OP.1 FDD | OP.1 FDD | EVA5 | EVA 5 | 2x2 Medium | 70 | 3.4 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms. | | | | | | | | | |

#### 8.2.1.3 Open-loop spatial multiplexing performance

##### 8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas. For CA the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| PDSCH transmission mode | |  | 3 |
| Note 1: .  Note 2: Void.  Note 3: Void. | | | |

Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Referencechannel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 13.0 | 2-8 |
| Note 1: Void.  Note 2: Test 1 may not be executed for UE-s for which Test 1 or 2 in Table 8.2.1.3.1-4 is applicable. | | | | | | | | |

Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| PDSCH transmission mode | |  | 3 |
| Note 1: .  Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.  Note 3: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.1.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Reference channel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 2x10 MHz | R.11 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.7 | 3-8 |
| 2 | 2x20 MHz | R.30 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: Void.  Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

##### 8.2.1.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation.

Table 8.2.1.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| PDSCH transmission mode | |  | 3 |
| Note 1:  Note 2: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.  Note 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.1.3.1A-2: Minimum performance for soft buffer management test (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Referencechannel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 2x20 MHz | R.30 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 3 |
| 2 | 2x20 MHz | R.35-1 FDD | OP.1 FDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.8 | 4 |
| Note 1: For CA test cases, the OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

##### 8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.1.3.2-1: Test Parameters for Large Delay CDD (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| PDSCH transmission mode | |  | 3 |
| Note 1: | | | |

Table 8.2.1.3.2-2: Minimum performance Large Delay CDD (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.14 FDD | OP.1 FDD | EVA70 | 4x2 Low | 70 | 14.3 | 2-8 |

##### 8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 (Note 1) | -3 |
| σ | dB | 0 | N/A |
| at antenna port |  | dBm/15kHz | -102 (Note 2) | N/A |
|  | dBm/15kHz | -98 (Note 3) | N/A |
|  | dBm/15kHz | -94.8 (Note 4) | N/A |
|  | | dB | Reference Value in Table 8.2.1.3.3-2 | 6 |
| BWChannel | | MHz | 10 | 10 |
| Subframe Configuration | |  | Non-MBSFN | Non-MBSFN |
| Cell Id | |  | 0 | 1 |
| Time Offset between Cells | | μs | 2.5 (synchronous cells) | |
| ABS pattern (Note 5) | |  | N/A | 11000100, 11000000, 11000000, 11000000, 11000000 |
| RLM/RRM Measurement Subframe Pattern(Note 6) | |  | 10000000  10000000  10000000  10000000  10000000 | N/A |
| CSI Subframe Sets (Note 7) | CCSI,0 |  | 11000100 11000000 11000000 11000000 11000000 | N/A |
| CCSI,1 |  | 00111011 00111111 00111111 00111111 00111111 | N/A |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 3 | N/A |
| Cyclic prefix | |  | Normal | Normal |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 5: ABS pattern as defined in [9].  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test. | | | | |

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |  | |
| 1 | R.11 FDD (Note 4) | OP.1 FDD | OP.1 FDD | EVA 5 | EVA 5 | 2x2 Low | 70 | 13.3 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms. | | | | | | | | | |

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 (Note 1) | -3 |
| σ | dB | 0 | N/A |
| at antenna port |  | dBm/15kHz | -102 (Note 2) | N/A |
|  | dBm/15kHz | -98 (Note 3) | N/A |
|  | dBm/15kHz | -94.8 (Note 4) | N/A |
|  | | dB | Reference Value in Table 8.2.1.3.3-4 | 6 |
| BWChannel | | MHz | 10 | 10 |
| Subframe Configuration | |  | Non-MBSFN | MBSFN |
| Cell Id | |  | 0 | 126 |
| Time Offset between Cells | | μs | 2.5 (synchronous cells) | |
| ABS pattern(Note 5) | |  | N/A | 0001000000 0100000010 0000001000 0000000000 |
| RLM/RRM Measurement Subframe Pattern(Note 6) | |  | 0001000000 0100000010 0000001000 0000000000 | N/A |
| CSI Subframe Sets(Note 7) | CCSI,0 |  | 0001000000 0100000010 0000001000 0000000000 | N/A |
| CCSI,1 |  | 1110111111 1011111101 1111110111 1111111111 | N/A |
| MBSFN Subframe Allocation (Note 10) | |  | N/A | 001000  100001  000100  000000 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 3 | N/A |
| Cyclic prefix | |  | Normal | Normal |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 5: ABS pattern as defined in [9]. The 4th, 12th, 19th and 27th subframes indicated by ABS pattern are MBSFN ABS subframes.  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test.  Note 10: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.  Note 11: The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test. | | | | |

Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category | |
| **Cell 1** | **Cell 2** | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |  | |
| 1 | R.11 FDD (Note 4) | OP.1 FDD | OP.1 FDD | EVA 5 | EVA 5 | 2x2 Low | 70 | 12.0 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 4 subframes, averaged over 40ms. | | | | | | | | | |

#### 8.2.1.4 Closed-loop spatial multiplexing performance

##### 8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Test 1 | | Test 2 | |
| Downlink power allocation |  | | dB | | -3 | | -3 | |
|  | | dB | | -3 (Note 1) | | -3 (Note 1) | |
| σ | | dB | | 0 | | 0 | |
| at antenna port | | | dBm/15kHz | | -98 | | -98 | |
| Precoding granularity | | | PRB | | 6 | | 50 | |
| PMI delay (Note 2) | | | ms | | 8 | | 8 | |
| Reporting interval | | | ms | | 1 | | 1 | |
| Reporting mode | | |  | | PUSCH 1-2 | | PUSCH 3-1 | |
| CodeBookSubsetRestriction bitmap | | |  | | 001111 | | 001111 | |
| PDSCH transmission mode | | |  | | 4 | | 4 | |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | | | | | | |

Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.10 FDD | OP.1 FDD | EVA5 | 2x2 Low | 70 | -2.5 | 1-8 |
| 2 | 10 MHz | R.10 FDD | OP.1 FDD | EPA5 | 2x2 High | 70 | -2.3 | 1-8 |

##### 8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Test 1 | |
| Downlink power allocation |  | | dB | | -6 | |
|  | | dB | | -6 (Note 1) | |
| σ | | dB | | 3 | |
| at antenna port | | | dBm/15kHz | | -98 | |
| Precoding granularity | | | PRB | | 6 | |
| PMI delay (Note 2) | | | ms | | 8 | |
| Reporting interval | | | ms | | 1 | |
| Reporting mode | | |  | | PUSCH 1-2 | |
| CodeBookSubsetRestriction bitmap | | |  | | 0000000000000000000000000000000000000000000000001111111111111111 | |
| PDSCH transmission mode | | |  | | 4 | |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | | | | |

Table 8.2.1.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.13 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | -3.2 | 1-8 |

##### 8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2,with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 50 |
| PMI delay (Note 2) | | ms | 8 |
| Reporting interval | | ms | 1 |
| Reporting mode | |  | PUSCH 3-1 |
| CodeBookSubsetRestriction bitmap | |  | 110000 |
| PDSCH transmission mode | |  | 4 |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | | |

Table 8.2.1.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.35 FDD | OP.1 FDD | EPA5 | 2x2 Low | 70 | 18.9 | 2-8 |
| 2 | 10 MHz | R.11 FDD | OP.1 FDD | ETU70 | 2x2 Low | 70 | 14.3 | 2-8 |

##### 8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-2 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 6 |
| PMI delay (Note 2) | | ms | 8 |
| Reporting interval | | ms | 1 |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| PDSCH transmission mode | |  | 4 |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: Void.  Note 4: Void.  Note 5: Void. | | | |

Table 8.2.1.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Referencechannel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.36 FDD | OP.1 FDD | EPA5 | 4x2 Low | 70 | 14.7 | 2-8 |
| Note 1: Void. | | | | | | | | |

Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 (Note 1) | -6 (Note 1) |
| σ | dB | 3 | 3 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Precoding granularity | | PRB | 6 | 8 |
| PMI delay (Note 2) | | ms | 8 | 8 |
| Reporting interval | | ms | 1 | 1 |
| Reporting mode | |  | PUSCH 1-2 | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 | 0000000000000000000000000000000011111111111111110000000000000000 |
| CSI request field (Note 3) | |  | ‘10’ | |
| PDSCH transmission mode | |  | 4 | |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher layers.  Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 1b with channel selection configured.  Note 5: The same PDSCH transmission mode is applied to each component carrier. | | | | |

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Referencechannel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE cate-  gory |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1 | 2x10 MHz | R.14 FDD | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | 10.8 | 3-8 |
| 2 | 2x20 MHz | R.14-3 FDD | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | [10.9] | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

#### 8.2.1.5 MU-MIMO

#### 8.2.1.6 [Control channel performance: D-BCH and PCH]

#### 8.2.1.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

##### 8.2.1.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.7.1-1: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | 0 |
| at antenna port of PCell | | dBm/15kHz | -85 |
| at antenna port of Scell | | dBm/15kHz | -79 |
| at antenna port | | dBm/15kHz | Off (Note 2) |
| Symbols for unused PRBs | |  | OCNG (Note 3) |
| Modulation | |  | 64 QAM |
| Maximum number of HARQ transmission | |  | 1 |
| Redundancy version coding sequence | |  | {0} |
| PDSCH transmission mode of PCell | |  | 1 |
| PDSCH tramsmission mode of SCell | |  | 3 |
| Note 1: .  Note 2: No external noise sources are applied  Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data.  Note 4: Void | | | |

Table 8.2.1.7.1-2: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Band-width | Reference Channel | | OCNG Pattern | | Propagation Conditions | | Correlation Matrix and Antenna | | Reference value  Fraction of Maximum  Throughput (%) | | UE Category |
| PCell | SCell | PCell | SCell | PCell | SCell | PCell | SCell | PCell | SCell |
| 1 | 2x20MHz | R.49 FDD | NA | OP.1 FDD | OP.5 FDD | Clause B.1 | Clause B.1 | 1x2 | 2x2 | 85% | NA | ≥5 |
| Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | | | | | |

### 8.2.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.2.2-1: Common Test Parameters (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Uplink downlink configuration (Note 1) | | |  | 1 | |
| Special subframe configuration (Note 2) | | |  | 4 | |
| Cyclic prefix | | |  | Normal | |
| Cell ID | | |  | 0 | |
| Inter-TTI Distance | | |  | 1 | |
| Number of HARQ processes per component carrier | | | Processes | 7 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,1,2,3} for QPSK and 16QAM  {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbols | 4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths,  2 for 10 MHz, 15 MHz and 20 MHz bandwidths | |
| Cross carrier scheduling | | |  | Not configured | |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4]. | | | | | |

#### 8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

##### 8.2.2.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.1.1-1: Test Parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1- 5 | Test 6- 8 | Test 9- 15 | Test 16- 18 | Test 19 |
| Downlink power allocation |  | dB | 0 | 0 | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | 0 | 0 | 0 | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) |
| Modulation | |  | QPSK | 16QAM | 64QAM | 16QAM | QPSK |
| ACK/NACK feedback mode | |  | Multiplexing | Multiplexing | Multiplexing | Multiplexing | Multiplexing |
| PDSCH transmission mode | |  | 1 | 1 | 1 | 1 | 1 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 3: Void.  Note 4: Void. | | | | | | | |

Table 8.2.2.1.1-2: Minimum performance (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.2 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -1.2 | 1-8 |
| 2 | 10 MHz | R.2 TDD | OP.1 TDD | ETU70 | 1x2 Low | 70 | -0.6 | 1-8 |
| 3 | 10 MHz | R.2 TDD | OP.1 TDD | ETU300 | 1x2 Low | 70 | -0.2 | 1-8 |
| 4 | 10 MHz | R.2 TDD | OP.1 TDD | HST | 1x2 | 70 | -2.6 | 1-8 |
| 5 | 1.4 MHz | R.4 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 0.0 | 1-8 |
| 6 | 10 MHz | R.3 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 6.7 | 2-8 |
| 5 MHz | R.3-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 6.7 | 1 |
| 7 | 10 MHz | R.3 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 1.4 | 2-8 |
| 5 MHz | R.3-1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 1.4 | 1 |
| 8 | 10 MHz | R.3 TDD | OP.1 TDD | ETU300 | 1x2 High | 70 | 9.3 | 2-8 |
| 5 MHz | R.3-1 TDD | OP.1 TDD | ETU300 | 1x2 High | 70 | 9.3 | 1 |
| 9 | 3 MHz | R.5 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | 1-8 |
| 10 | 5 MHz | R.6 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | 2-8 |
| 5 MHz | R.6-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | 1 |
| 11 | 10 MHz | R.7 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | 2-8 |
| 10 MHz | R.7-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | 1 |
| 12 | 10 MHz | R.7 TDD | OP.1 TDD | ETU70 | 1x2 Low | 70 | 19.1 | 2-8 |
| 10 MHz | R.7-1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 70 | 19.1 | 1 |
| 13 | 10 MHz | R.7 TDD | OP.1 TDD | EVA5 | 1x2 High | 70 | 19.1 | 2-8 |
| 10 MHz | R.7-1 TDD | OP.1 TDD | EVA5 | 1x2 High | 70 | 19.1 | 1 |
| 14 | 15 MHz | R.8 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.8 | 2-8 |
| 15 MHz | R.8-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.8 | 1 |
| 15 | 20 MHz | R.9 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.7 | 3-8 |
| 20 MHz | R.9-2 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.7 | 2 |
| 20 MHz | R.9-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.7 | 1 |
| 16 | 3 MHz | R.0 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 2.1 | 1-8 |
| 17 | 10 MHz | R.1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 2.0 | 1-8 |
| 18 | 20 MHz | R.1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 2.1 | 1-8 |
| 19 | 10 MHz | R.41 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -5.3 | 1-8 |
| Note 1: Void. | | | | | | | | |

Table 8.2.2.1.1-3: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
|  | σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) |
| Modulation | |  | QPSK |
| ACK/NACK feedback mode | |  | PUCCH format 1b with channel selection |
| PDSCH transmission mode | |  | 1 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 3: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.2.1.1-4: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 2x20MHz | R.42 TDD | OP.1 TDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.2 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

##### 8.2.2.1.2 Void

##### 8.2.2.1.3 Void

##### 8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1 | |
| Downlink power allocation | |  | | dB | | 0 |
|  | | dB | | 0 (Note 1) |
| σ | | dB | | 0 |
| at antenna port | | | | dBm/15kHz | | -98 |
| Symbols for MBSFN portion of MBSFN subframes (Note 2) | | | |  | | OCNG (Note 3) |
| ACK/NACK feedback mode | | | |  | | Multiplexing |
| PDSCH transmission mode | | | |  | | 1 |
| Note 1: .  Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the first slot.  Note 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes, QPSK modulated MBSFN data is used instead. | | | | | | |

Table 8.2.2.1.4-2: Minimum performance 1PRB (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.29 TDD | OP.3 TDD | ETU70 | 1x2 Low | 30 | 2.0 | 1-8 |

#### 8.2.2.2 Transmit diversity performance

##### 8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1-2 | |
| Downlink power allocation | |  | | dB | | -3 |
|  | | dB | | -3 (Note 1) |
| σ | | dB | | 0 |
| at antenna port | | | | dBm/15kHz | | -98 |
| ACK/NACK feedback mode | | | |  | | Multiplexing |
| PDSCH transmission mode | | | |  | | 2 |
| Note 1: | | | | | | |

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11 TDD | OP.1 TDD | EVA5 | 2x2 Medium | 70 | 6.8 | 2-8 |
| 5 MHz | R.11-2 TDD | OP.1 TDD | EVA5 | 2x2 Medium | 70 | 6.8 | 1 |
| 2 | 10 MHz | R.10 TDD | OP.1 TDD | HST | 2x2 | 70 | -2.3 | 1-8 |

##### 8.2.2.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

**Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | | **Test 1-2** | |
| Downlink power allocation | |  | | dB | | -3 |
|  | | dB | | -3 (Note 1) |
| σ | | dB | | 0 |
| at antenna port | | | | dBm/15kHz | | -98 |
| ACK/NACK feedback mode | | | |  | | Multiplexing |
| PDSCH transmission mode | | | |  | | 2 |
| Note 1: | | | | | | |

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 1.4 MHz | R.12 TDD | OP.1 TDD | EPA5 | 4x2 Medium | 70 | 0.2 | 1-8 |
| 2 | 10 MHz | R.13 TDD | OP.1 TDD | ETU70 | 4x2 Low | 70 | -0.5 | 1-8 |

##### 8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.2.3-2, with the addition of parameters in Table 8.2.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | Cell 1 | | Cell 2 | | |
| Uplink downlink configuration | | | |  | | 1 | | 1 | | |
| Special subframe configuration | | | |  | | 4 | | 4 | | |
| Downlink power allocation | |  | | dB | | -3 | | -3 | | |
|  | | dB | | -3 (Note 1) | | -3 (Note 1) | | |
| σ | | dB | | 0 | | N/A | | |
| at antenna port | | |  | dBm/15kHz | | -102 (Note 2) | | N/A | | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | |
|  | dBm/15kHz | | -94.8 (Note 4) | | N/A | | |
|  | | | | dB | | Reference Value in Table 8.2.2.2.3-2 | | 6 | | |
| BWChannel | | | | MHz | | 10 | | 10 | | |
| Subframe Configuration | | | |  | | Non-MBSFN | | Non-MBSFN | | |
| Time Offset between Cells | | | | μs | | 2.5 (synchronous cells) | | | | |
| Cell Id | | | |  | | 0 | | 1 | | |
| ABS pattern (Note 5) | | | |  | | N/A | | 0000010001 0000000001 | | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | | |  | | 0000000001  0000000001 | | N/A | | |
| CSI Subframe Sets (Note 7) | | | CCSI,0 |  | | 0000010001 0000000001 | | N/A | | |
| CCSI,1 |  | | 1100101000 1100111000 | | N/A | | |
| Number of control OFDM symbols | | | |  | | 2 | | 2 | | |
| ACK/NACK feedback mode | | | |  | | Multiplexing | | N/A | | |
| PDSCH transmission mode | | | |  | | 2 | | N/A | | |
| Cyclic prefix | | | |  | | Normal | | Normal | | |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 5: ABS pattern as defined in [9].  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test. | | | | | | | | | | |

Table 8.2.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |
| 1 | R.11-4 TDD (Note 4) | OP.1 TDD | OP.1 TDD | EVA5 | EVA5 | 2x2 Medium | 70 | 3.8 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. | | | | | | | | | |

#### 8.2.2.3 Open-loop spatial multiplexing performance

##### 8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| ACK/NACK feedback mode | |  | Bundling |
| PDSCH transmission mode | |  | 3 |
| Note 1:  Note 2: Void.  Note 3: Void. | | | |

Table 8.2.2.3.1-2: Minimum performance Large Delay CDD (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11-1 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.1 | 2-8 |
| Note 1: Void. | | | | | | | | |

Table 8.2.2.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| ACK/NACK feedback mode | |  | PUCCH format 1b with channel selection |
| PDSCH transmission mode | |  | 3 |
| Note 1:  Note 2: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 2x20 MHz | R.30-1 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.7 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

##### 8.2.2.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| ACK/NACK feedback mode | |  | -  (Note 2) |
| PDSCH transmission mode | |  | 3 |
| Note 1:  Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.  Note 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.2.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category | CA capability |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 2x20 MHz | R.30-2 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 3 | CL\_C |
| 2 | 2x20 MHz | R.35-1 TDD | OP.1 TDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.7 | 4 | CL\_C |
| Note 1: For CA test cases, the OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | | |

##### 8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.2.3.2-1: Test Parameters for Large Delay CDD (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| ACK/NACK feedback mode | |  | Bundling |
| PDSCH transmission mode | |  | 3 |
| Note 1: . | | | |

Table 8.2.2.3.2-2: Minimum performance Large Delay CDD (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.14 TDD | OP.1 TDD | EVA70 | 4x2 Low | 70 | 14.2 | 2-8 |

##### 8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 |
| Uplink downlink configuration | | |  | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 |
| Downlink power allocation |  | | dB | -3 | -3 |
|  | | dB | -3 (Note 1) | -3 (Note 1) |
| σ | | dB | 0 | N/A |
| at antenna port | |  | dBm/15kHz | -102 (Note 2) | N/A |
|  | dBm/15kHz | -98 (Note 3) | N/A |
|  | dBm/15kHz | -94.8 (Note 4) | N/A |
|  | | | dB | Reference Value in Table 8.2.2.3.3-2 | 6 |
| BWChannel | | | MHz | 10 | 10 |
| Subframe Configuration | | |  | Non-MBSFN | Non-MBSFN |
| Cell Id | | |  | 0 | 1 |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | |
| ABS pattern (Note 5) | | |  | N/A | 0000010001, 0000000001 |
| RLM/RRM Measurement Subframe Pattern(Note 6) | | |  | 0000000001, 0000000001 | N/A |
| CSI Subframe Sets (Note 7) | | CCSI,0 |  | 0000010001, 0000000001 | N/A |
| CCSI,1 |  | 1100101000 1100111000 | N/A |
| Number of control OFDM symbols | | |  | 2 | 2 |
| ACK/NACK feedback mode | | |  | Multiplexing | N/A |
| PDSCH transmission mode | | |  | 3 | N/A |
| Cyclic prefix | | |  | Normal | Normal |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 5: ABS pattern as defined in [9].  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test. | | | | | |

Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |
| 1 | R.11 TDD (Note 4) | OP.1 TDD | OP.1 TDD | EVA 5 | EVA 5 | 2x2 Low | 70 | 14.0 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. | | | | | | | | | |

Table 8.2.2.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 |
| Uplink downlink configuration | | |  | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 |
| Downlink power allocation |  | | dB | -3 | -3 |
|  | | dB | -3 (Note 1) | -3 (Note 1) |
| σ | | dB | 0 | N/A |
| at antenna port | |  | dBm/15kHz | -102 (Note 2) | N/A |
|  | dBm/15kHz | -98 (Note 3) | N/A |
|  | dBm/15kHz | -94.8 (Note 4) | N/A |
|  | | | dB | Reference Value in Table 8.2.2.3.3-4 | 6 |
| BWChannel | | | MHz | 10 | 10 |
| Subframe Configuration | | |  | Non-MBSFN | MBSFN |
| Cell Id | | |  | 0 | 126 |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | |
| ABS pattern (Note 5) | | |  | N/A | 0000000001 0000000001 |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | 0000000001 0000000001 | N/A |
| CSI Subframe Sets (Note 7) | | CCSI,0 |  | 0000000001 0000000001 | N/A |
| CCSI,1 |  | 1100111000 1100111000 | N/A |
| MBSFN Subframe Allocation (Note 10) | | |  | N/A | 000010 |
| Number of control OFDM symbols | | |  | 2 | 2 |
| ACK/NACK feedback mode | | |  | Multiplexing | N/A |
| PDSCH transmission mode | | |  | 3 | N/A |
| Cyclic prefix | | |  | Normal | Normal |
| Note 1: .  Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10,#11, #12, #13 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 5: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.  Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 9: SIB-1 will not be transmitted in Cell2 in this test.  Note 10: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation. | | | | | |

Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) (Note 5) | SNR (dB) (Note 2) |
| 1 | R.11 TDD (Note 4) | OP.1 TDD | OP.1 TDD | EVA 5 | EVA 5 | 2x2 Low | 70 | 12.2 | 2-8 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.  Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. | | | | | | | | | |

#### 8.2.2.4 Closed-loop spatial multiplexing performance

##### 8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | | **Test 1** | | **Test 2** | |
| Downlink power allocation |  | | dB | | -3 | | -3 | |
|  | | dB | | -3 (Note 1) | | -3 (Note 1) | |
| σ | | dB | | 0 | | 0 | |
| at antenna port | | | dBm/15kHz | | -98 | | -98 | |
| Precoding granularity | | | PRB | | 6 | | 50 | |
| PMI delay (Note 2) | | | ms | | 10 or 11 | | 10 or 11 | |
| Reporting interval | | | ms | | 1 or 4 (Note 3) | | 1 or 4 (Note 3) | |
| Reporting mode | | |  | | PUSCH 1-2 | | PUSCH 3-1 | |
| CodeBookSubsetRestriction bitmap | | |  | | 001111 | | 001111 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | Multiplexing | |
| PDSCH transmission mode | | |  | | 4 | | 4 | |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms. | | | | | | | | |

Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.10 TDD | OP.1 TDD | EVA5 | 2x2 Low | 70 | -3.1 | 1-8 |
| 2 | 10 MHz | R.10 TDD | OP.1 TDD | EPA5 | 2x2 High | 70 | -2.8 | 1-8 |

##### 8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | | Test 1 | | |
| Downlink power allocation |  | | | dB | | | -6 | | |
|  | | | dB | | | -6 (Note 1) | | |
| σ | | | dB | | | 3 | | |
| at antenna port | | | | dBm/15kHz | | | -98 | | |
| Precoding granularity | | | | PRB | | | 6 | | |
| PMI delay (Note 2) | | | | ms | | | 10 or 11 | | |
| Reporting interval | | | | ms | | | 1 or 4 (Note 3) | | |
| Reporting mode | | | |  | | | PUSCH 1-2 | | |
| CodeBookSubsetRestriction bitmap | | | |  | | | 0000000000000000000000000000000000000000000000001111111111111111 | | |
| ACK/NACK feedback mode | | | |  | | | Multiplexing | | |
| PDSCH transmission mode | | | |  | | | 4 | | |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms. | | | | | | | | | |

Table 8.2.2.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth** | **Reference Channel** | OCNG Pattern | **Propagation Condition** | **Correlation Matrix and Antenna Configuration** | **Reference value** | | **UE Category** |
| **Fraction of Maximum**  **Throughput (%)** | **SNR (dB)** |
| 1 | 10 MHz | R.13 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | -3.5 | 1-8 |

##### 8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1-2** |
| Downlink power allocation | |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | | dBm/15kHz | -98 |
| Precoding granularity | | | PRB | 50 |
| PMI delay (Note 2) | | | ms | 10 or 11 |
| Reporting interval | | | ms | 1 or 4 (Note 3) |
| Reporting mode | | |  | PUSCH 3-1 |
| ACK/NACK feedback mode | | |  | Bundling |
| CodeBookSubsetRestriction bitmap | | |  | 110000 |
| PDSCH transmission mode | | |  | 4 |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms. | | | | |

Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.35 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 19.5 | 2-8 |
| 2 | 10 MHz | R.11-1 TDD | OP.1 TDD | ETU70 | 2x2 Low | 70 | 13.9 | 2-8 |

##### 8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 6 |
| PMI delay (Note 2) | | ms | 10 or 11 |
| Reporting interval | | ms | 1 or 4 (Note 3) |
| Reporting mode | |  | PUSCH 1-2 |
| ACK/NACK feedback mode | |  | Bundling |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| PDSCH transmission mode | |  | 4 |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.  Note 4: Void.  Note 5: Void.  Note 6: Void. | | | |

Table 8.2.2.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| **Fraction of Maximum**  **Throughput (%)** | **SNR (dB)** |
| 1 | 10 MHz | R.36 TDD | OP.1 TDD | EPA5 | 4x2 Low | 70 | 15.7 | 2-8 |
| Note 1: Void. | | | | | | | | |

Table 8.2.2.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 8 |
| PMI delay (Note 2) | | ms | 10 or 11 |
| Reporting interval | | ms | 1 or 4 (Note 3) |
| Reporting mode | |  | PUSCH 1-2 |
| ACK/NACK feedback mode | |  | PUCCH format 1b with channel selection |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| CSI request field (Note 4) | |  | ‘10’ |
| PDSCH transmission mode | |  | 4 |
| Note 1: .  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)  Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.  Note 4: Multiple CC-s under test are configured as the 1st set of serving cells by high layers.  Note 5: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| **Fraction of Maximum**  **Throughput (%)** | **SNR (dB)** |
| 1 | 2x20 MHz | R.43 TDD | OP.1 TDD (Note 1) | EVA5 | 4x2 Low | 70 | 11.1 | 5-8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

#### 8.2.2.5 MU-MIMO

#### 8.2.2.6 [Control channel performance: D-BCH and PCH]

#### 8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

##### 8.2.2.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.7.1-1: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | 0 |
| at antenna port of PCell | | dBm/15kHz | -85 |
| at antenna port of Scell | | dBm/15kHz | -79 |
| at antenna port | | dBm/15kHz | Off (Note 2) |
| Symbols for unused PRBs | |  | OCNG (Note 3) |
| Modulation | |  | 64 QAM |
| Maximum number of HARQ transmission | |  | 1 |
| Redundancy version coding sequence | |  | {0} |
| PDSCH transmission mode of PCell | |  | 1 |
| PDSCH transmission mode of SCell | |  | 3 |
| Note 1: .  Note 2: No external noise sources are applied.  Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data. | | | |

Table 8.2.2.7.1-2: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Band-width | Reference Channel | | OCNG Pattern | | Propagation Conditions | | Correlation Matrix and Antenna | | Reference value  Fraction of Maximum  Throughput (%) | | UE Category |
| PCell | SCell | PCell | SCell | PCell | SCell | PCell | SCell | PCell | SCell |
| 1 | 2x20MHz | R.49 TDD | NA | OP.1 TDD | OP.5 TDD | Clause B.1 | Clause B.1 | 1x2 | 2x2 | 85% | NA | ≥5 |
| Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.  Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | | | | | |

## 8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

### 8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Cyclic prefix | | |  | Normal | |
| Cell ID | | |  | 0 | |
| Inter-TTI Distance | | |  | 1 | |
| Number of HARQ processes | | | Processes | 8 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,1,2,3} for QPSK and 16QAM  {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH | | | OFDM symbols | 2 | |
| Precoder update granularity | | |  | Frequency domain: 1 PRG for Transmission mode 9  Time domain: 1 ms | |
| Note 1: Void  Note 2: Void | | | | | |

#### 8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | Test 1 | Test 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | |
| CSI reference signals | |  | Antenna ports 15,…,18 | Antenna ports 15,…,18 |
| Beamforming model | |  | Annex B.4.1 | Annex B.4.1 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 | 5 / 2 |
| CSI reference signal configuration | |  | 0 | 3 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 3 /  0001000000000000 | 3 /  0001000000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | 50 |
| Simultaneous transmission | |  | No | Yes (Note 3, 5) |
| PDSCH transmission mode | |  | 9 | 9 |
| Note 1: .  Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.  Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.  Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 5: The two UEs’ scrambling identities  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases. | | | | |

Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.43 FDD | OP.1 FDD | EVA5 | 2x2 Low | 70 | -1 | 1-8 |

Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 2 | 10 MHz  64QAM 1/2 | R.50 FDD | OP.1 FDD | EPA5 | 2x2 Low | 70 | 21.9 | 2-8 |
| Note 1: The reference channel applies to both the input signal under test and the interfering signal. | | | | | | | | |

#### 8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

|  |  |  |  |
| --- | --- | --- | --- |
| parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | -3 |
| Cell-specific reference signals | |  | Antenna ports 0 and 1 |
| CSI reference signals | |  | Antenna ports 15,16 |
| Beamforming model | |  | Annex B.4.2 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 |
| CSI reference signal configuration | |  | 8 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 3 /  0010000000000000 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 |
| Simultaneous transmission | |  | No |
| PDSCH transmission mode | |  | 9 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. | | | |

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  16QAM 1/2 | R.51 FDD | OP.1 FDD | EPA5 | 2x2 Low | 70 | 13.3 | 2-8 |

### 8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Uplink downlink configuration (Note 1) | | |  | 1 | |
| Special subframe configuration (Note 2) | | |  | 4 | |
| Cyclic prefix | | |  | Normal | |
| Cell ID | | |  | 0 | |
| Inter-TTI Distance | | |  | 1 | |
| Number of HARQ processes | | | Processes | 7 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,1,2,3} for QPSK and 16QAM  {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH | | | OFDM symbols | 2 | |
| Precoder update granularity | | |  | Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission mode 9  Time domain: 1 ms | |
| ACK/NACK feedback mode | | |  | Multiplexing | |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4]  Note 2: as specified in Table 4.2-1 in TS 36.211 [4] | | | | | |

#### 8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

Table 8.3.2.1-1: Test Parameters for Testing DRS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | Test 4 |
| Downlink power allocation |  | dB | 0 | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | 0 | 0 | 0 | 0 |
| Cell-specific reference signals | |  | Antenna port 0 | | | |
| Beamforming model | |  | Annex B.4.1 | | | |
| at antenna port | | dB/15kHz | -98 | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) | OCNG (Note 2) |
| PDSCH transmission mode | |  | 7 | 7 | 7 | 7 |
| Note 1: .  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. | | | | | | |

Table 8.3.2.1-2: Minimum performance DRS (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.25 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | -0.8 | 1-5 |
| 2 | 10 MHz  16QAM 1/2 | R.26 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 7.0 | 2-5 |
| 5MHz  16QAM 1/2 | R.26-1 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 7.0 | 1 |
| 3 | 10 MHz  64QAM 3/4 | R.27 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 17.0 | 2-5 |
| 10 MHz  64QAM 3/4 | R.27-1 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 17.0 | 1 |
| 4 | 10 MHz  16QAM 1/2 | R.28 TDD | OP.1 TDD | EPA5 | 2x2 Low | 30 | 1.7 | 1-5 |

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 |
| Downlink power allocation |  | dB | 0 | 0 | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | -3 | -3 | -3 | -3 | -3 |
| Cell-specific reference signals | |  | Antenna port 0 and antenna port 1 | | | | |
| Beamforming model | |  | Annex B.4.1 | | | | |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) | OCNG (Note 4) | OCNG (Note 4) | OCNG (Note 4) |
| Simultaneous transmission | |  | No | No | No | Yes  (Note 3, 5) | Yes  (Note 3, 5) |
| PDSCH transmission mode | |  | 8 | 8 | 8 | 8 | 8 |
| Note 1: .  Note 2: The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.  Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.  Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 5: The two UEs’ scrambling identities  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases. | | | | | | | |

Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.31 TDD | OP.1 TDD | EVA5 | 2x2 Low | 70 | -1.0 | 1-5 |
| 2 | 10 MHz  16QAM 1/2 | R.32 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 7.7 | 2-5 |
| 5MHz  16QAM 1/2 | R.32-1 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 7.7 | 1 |
| 3 | 10 MHz  64QAM 3/4 | R.33 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 17.7 | 2-5 |
| 10 MHz  64QAM 3/4 | R.33-1 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 17.7 | 1 |

Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 4 | 10 MHz  16QAM 1/2 | R.32 TDD (Note 1) | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 21.9 | 2-5 |
| 5 | 10 MHz  64QAM 1/2 | R.34 TDD (Note 1) | OP.1 TDD | EPA5 | 2x2 Low | 70 | 22.0 | 2-5 |
| Note 1: The reference channel applies to both the input signal under test and the interfering signal. | | | | | | | | |

#### 8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | |
| CSI reference signals | |  | Antenna ports 15,…,22 | Antenna ports 15,…,18 |
| Beamforming model | |  | Annex B.4.1 | Annex B.4.1 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 | 5 / 4 |
| CSI reference signal configuration | |  | 1 | 3 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 4 /  0010000100000000 | 4 / 0010000000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | 50 |
| Simultaneous transmission | |  | No | Yes (Note 3, 5) |
| PDSCH transmission mode | |  | 9 | 9 |
| Note 1: .  Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.  Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.  Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.  Note 5: The two UEs’ scrambling identities  are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases. | | | | |

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.50 TDD | OP.1 TDD | EVA5 | 2x2 Low | 70 | -0.6 | 1-8 |

Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 2 | 10 MHz  64QAM 1/2 | R.44 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 22.1 | 2-8 |
| Note 1: The reference channel applies to both the input signal under test and the interfering signal. | | | | | | | | |

#### 8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Test 1 | Test 2 |
| Downlink power allocation |  | dB | | 0 | 0 |
|  | dB | | 0 (Note 1) | 0 (Note 1) |
| σ | dB | | -3 | -3 |
| Cell-specific reference symbols | |  | | Antenna port 0 and antenna port 1 | |
| Beamforming model | |  | Annex B.4.2 | | |
| at antenna port | | dBm/15kHz | | -98 | -98 |
| Symbols for unused PRBs | |  | | OCNG  (Note 2) | OCNG  (Note 2) |
| Number of allocated resource blocks | | PRB | | 50 | 50 |
| PDSCH transmission mode | |  | | 8 | 8 |
| Note 1: .  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. | | | | | |

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.31 TDD | OP.1 TDD | EVA5 | 2x2 Low | 70 | 4.5 | 2-5 |
| 2 | 10 MHz  16QAM 1/2 | R.32 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 21.7 | 2-5 |

#### 8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

|  |  |  |  |
| --- | --- | --- | --- |
| parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | -3 |
| Cell-specific reference signals | |  | Antenna ports 0 and 1 |
| CSI reference signals | |  | Antenna ports 15,16 |
| Beamforming model | |  | Annex B.4.2 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 |
| CSI reference signal configuration | |  | 8 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 4 /  0010000000000000 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 2) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 |
| Simultaneous transmission | |  | No |
| PDSCH transmission mode | |  | 9 |
| Note 1:  Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. | | | |

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  16QAM 1/2 | R.51 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 14.5 | 2-8 |

## 8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH.

### 8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |
| Number of PDCCH symbols | | symbols | 2 | 2 |
| PHICH Ng (Note 1) | |  | 1 | 1 |
| PHICH duration | |  | Normal | Normal |
| Unused RE-s and PRB-s | |  | OCNG | OCNG |
| Cell ID | |  | 0 | 0 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | 0 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | 0 | -3 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Cyclic prefix | |  | Normal | Normal |
| Note 1: According to Clause 6.9 in TS 36.211 [4] | | | | |

#### 8.4.1.1 Single-antenna port performance

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 8 CCE | R.15 FDD | OP.1 FDD | ETU70 | 1x2 Low | 1 | -1.7 |

#### 8.4.1.2 Transmit diversity performance

##### 8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 4 CCE | R.16 FDD | OP.1 FDD | EVA70 | 2 x 2 Low | 1 | -0.6 |

##### 8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 5 MHz | 2 CCE | R.17 FDD | OP.1 FDD | EPA5 | 4 x 2 Medium | 1 | 6.3 |

##### 8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2. and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. In Table 8.4.1.2.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | -3 | -3 |
| at antenna port | |  | dBm/15kHz | -100.5 (Note 1) | N/A |
|  | dBm/15kHz | -98 (Note 2) | N/A |
|  | dBm/15kHz | -95.3 (Note 3) | N/A |
|  | | | dB | Reference Value in Table 8.4.1.2.3-2 | 1.5 |
| BWChannel | | | MHz | 10 | 10 |
| Subframe Configuration | | |  | Non-MBSFN | Non-MBSFN |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | |
| Cell Id | | |  | 0 | 1 |
| ABS pattern (Note 4) | | |  | N/A | 00000100 00000100 00000100 01000100 00000100 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | | |  | 00000100 00000100 00000100 00000100 00000100 | N/A |
| CSI Subframe Sets (Note 6) | | CCSI,0 |  | 00000100 00000100 00000100 01000100 00000100 | N/A |
| CCSI,1 |  | 11111011 11111011 11111011 10111011 11111011 | N/A |
| Number of control OFDM symbols | | |  | 3 | 3 |
| PHICH Ng (Note 9) | | |  | 1 | N/A |
| PHICH duration | | |  | extended | N/A |
| Unused RE-s and PRB-s | | |  | OCNG | OCNG |
| Cyclic prefix | | |  | Normal | Normal |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.  Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in the test  Note 9: According to Clause 6.9 in TS 36.211 [4]. | | | | | |

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Aggregation Level | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-dsg (%) | SNR (dB) (Note 2) |
| 1 | 8 CCE | R15-1 FDD | OP.1 FDD | OP.1 FDD | EVA5 | EVA5 | 2x2 Low | 1 | -3.9 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | | |

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | -3 | -3 |
| at antenna port | |  | dBm/15kHz | -100.5 (Note 1) | N/A |
|  | dBm/15kHz | -98 (Note 2) | N/A |
|  | dBm/15kHz | -95.3 (Note 3) | N/A |
|  | | | dB | Reference Value in Table 8.4.1.2.3-4 | 1.5 |
| BWChannel | | | MHz | 10 | 10 |
| Subframe Configuration | | |  | Non-MBSFN | MBSFN |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | |
| Cell Id | | |  | 0 | 126 |
| ABS pattern (Note 4) | | |  | N/A | 0001000000 0100000010 0000001000 0000000000 |
| [RLM/RRM Measurement Subframe Pattern (Note 5)] | | |  | 0001000000 0100000010 0000001000 0000000000 | N/A |
| CSI Subframe Sets (Note 6) | | CCSI,0 |  | 0001000000 0100000010 0000001000 0000000000 | N/A |
| CCSI,1 |  | 1110111111 1011111101 1111110111 1111111111 | N/A |
| MBSFN Subframe Allocation (Note 9) | | |  | N/A | 001000  100001  000100  000000 |
| Number of control OFDM symbols | | |  | 3 | 3 |
| PHICH Ng (Note 11) | | |  | 1 | N/A |
| PHICH duration | | |  | extended | N/A |
| Unused RE-s and PRB-s | | |  | OCNG | OCNG |
| Cyclic prefix | | |  | Normal | Normal |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.  Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. The 4th, 12th, 19th and 27th subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in this test.  Note 9: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.  Note 10: The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.  Note 11: According to Clause 6.9 in TS 36.211 [4] | | | | | |

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Aggregation Level | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-dsg (%) | SNR (dB) (Note 2) |
| 1 | 8 CCE | R15-1 FDD | OP.1 FDD | OP.1 FDD | EVA5 | EVA5 | 2x2 Low | 1 | -4.2 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | | |

### 8.4.2 TDD

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |
| Uplink downlink configuration (Note 1) | |  | 0 | 0 |
| Special subframe configuration (Note 2) | |  | 4 | 4 |
| Number of PDCCH symbols | | symbols | 2 | 2 |
| PHICH Ng (Note 3) | |  | 1 | 1 |
| PHICH duration | |  | Normal | Normal |
| Unused RE-s and PRB-s | |  | OCNG | OCNG |
| Cell ID | |  | 0 | 0 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | 0 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | 0 | -3 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Cyclic prefix | |  | Normal | Normal |
| ACK/NACK feedback mode | |  | Multiplexing | Multiplexing |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4].  Note 3: According to Clause 6.9 in TS 36.211 [4] | | | | |

#### 8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.1-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 8 CCE | R.15 TDD | OP.1 TDD | ETU70 | 1x2 Low | 1 | -1.6 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | |
|  |  |  |
|  |  |  |  |  |  |  |  |  |

#### 8.4.2.2 Transmit diversity performance

##### 8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.1-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 4 CCE | R.16 TDD | OP.1 TDD | EVA70 | 2 x 2 Low | 1 | 0.1 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | |
|  |  |  |
|  |  |  |  |  |  |  |  |  |

##### 8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 5 MHz | 2 CCE | R.17 TDD | OP.1 TDD | EPA5 | 4 x 2 Medium | 1 | 6.5 |

##### 8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2. and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-4. In Table 8.4.2.2.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | |
| at antenna port |  | | dBm/15kHz | | -100.5 (Note 1) | | N/A | |
|  | | dBm/15kHz | | -98 (Note 2) | | N/A | |
|  | | dBm/15kHz | | -95.3 (Note 3) | | N/A | |
|  | | | dB | | Reference Value in Table 8.4.2.2.3-2 | | 1.5 | |
| BWChannel | | | MHz | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | 2.5 (synchronous cells) | | | |
| Cell Id | | |  | | 0 | | 1 | |
| ABS pattern (Note 4) | | |  | | N/A | | 0000010001 0000000001 | |
| RLM/RRM Measurement Subframe Pattern(Note 5) | | |  | | 0000000001 0000000001 | | N/A | |
| CSI Subframe Sets(Note 6) | CCSI,0 | |  | | 0000010001 0000000001 | | N/A | |
| CCSI,1 | |  | | 1100101000 1100111000 | | N/A | |
| Number of control OFDM symbols | | |  | | 3 | | 3 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | |
| PHICH Ng (Note 9) | | |  | | 1 | | N/A | |
| PHICH duration | | |  | | extended | | N/A | |
| Unused RE-s and PRB-s | | |  | | OCNG | | OCNG | |
| Cyclic prefix | | |  | | Normal | | Normal | |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in the test  Note 9: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | | |

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Aggregation Level | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1 | | Correlation Matrix and Antenna Configuration | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-dsg (%) | SNR (dB) (Note 2) |
| 1 | 8 CCE | R15-1 TDD | OP.1  TDD | OP.1  TDD | EVA5 | EVA5 | 2x2 Low | 1 | -3.9 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | | |

Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | | Cell 2 | |
| Uplink downlink configuration | | |  | 1 | | 1 | |
| Special subframe configuration | | |  | 4 | | 4 | |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | |
| at antenna port | |  | dBm/15kHz | | -100.5 (Note 1) | | N/A | |
|  | dBm/15kHz | | -98 (Note 2) | | N/A | |
|  | dBm/15kHz | | -95.3 (Note 3) | | N/A | |
|  | | | dB | | Reference Value in Table 8.4.2.2.3-4 | | 1.5 | |
| BWChannel | | | MHz | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | MBSFN | |
| Time Offset between Cells | | | μs | | 2.5 (synchronous cells) | | | |
| Cell Id | | |  | | 0 | | 126 | |
| ABS pattern (Note 4) | | |  | | N/A | | 0000000001 0000000001 | |
| RLM/RRM Measurement Subframe Pattern(Note 5) | | |  | | 0000000001 0000000001 | | N/A | |
| CSI Subframe Sets(Note 6) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | |
| MBSFN Subframe Allocation (Note 9) | | |  | | N/A | | 000010 | |
| Number of control OFDM symbols | | |  | | 3 | | 3 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | |
| PHICH Ng (Note 10) | | |  | | 1 | | N/A | |
| PHICH duration | | |  | | extended | | N/A | |
| Unused RE-s and PRB-s | | |  | | OCNG | | OCNG | |
| Cyclic prefix | | |  | | Normal | | Normal | |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.  Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.  Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in this test.  Note 9: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.  Note 10: According to Clause 6.9 in TS 36.211 [4] | | | | | | | | |

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Aggregation Level | Reference Channel | OCNG Pattern | | Propagation Conditions(Note 1) | | Correlation Matrix and Antenna Configuration | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-dsg (%) | SNR (dB) (Note 2) |
| 1 | 8 CCE | R15-1 TDD | OP.1 TDD | OP.1 TDD | EVA5 | EVA5 | 2x2 Low | 1 | -4.1 |
| Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | | |

## 8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

### 8.5.1 FDD

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.5.1-1: Test Parameters for PHICH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | 0 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | 0 | -3 |
| PHICH duration | |  | Normal | Normal |
| PHICH Ng (Note 1) | |  | Ng = 1 | Ng = 1 |
| PDCCH Content | |  | UL Grant should be included with the proper information aligned with A.3.6. | |
| Unused RE-s and PRB-s | |  | OCNG | OCNG |
| Cell ID | |  | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Cyclic prefix | |  | Normal | Normal |
| Note 1: according to Clause 6.9 in TS 36.211 [4] | | | | |

#### 8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.1-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 10 MHz | R.18 | OP.1 FDD | ETU70 | 1 x 2 Low | 0.1 | 5.5 |
| 2 | 10 MHz | R.24 | OP.1 FDD | ETU70 | 1 x 2 Low | 0.1 | 0.6 |

#### 8.5.1.2 Transmit diversity performance

##### 8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.1-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 10 MHz | R.19 | OP.1 FDD | EVA70 | 2 x 2 Low | 0.1 | 4.4 |

##### 8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.2-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 5 MHz | R.20 | OP.1 FDD | EPA5 | 4 x 2 Medium | 0.1 | 6.1 |

##### 8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.1.2.3-1: Test Parameters for PHICH

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | Cell 1 | | Cell 2 | |
| Downlink power allocation | | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | |
| at antenna port | | |  | dBm/15kHz | | -100.5 (Note 1) | | N/A | |
|  | dBm/15kHz | | -98 (Note 2) | | N/A | |
|  | dBm/15kHz | | -95.3 (Note 3) | | N/A | |
|  | | | | dB | | Reference Value in Table 8. 5.1.2.3-2 | | 1.5 | |
| BWChannel | | | | MHz | | 10 | | 10 | |
| Subframe Configuration | | | |  | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | | μs | | 2.5 (synchronous cells) | | | |
| Cell Id | | | |  | | 0 | | 1 | |
| ABS pattern (Note 4) | | | |  | | N/A | | 00000100 00000100 00000100 01000100 00000100 | |
| RLM/RRM Measurement Subframe Pattern (Note 5) | | | |  | | 00000100 00000100 00000100 00000100 00000100 | | N/A | |
| CSI Subframe Sets (Note 6) | | | CCSI,0 |  | | 00000100 00000100 00000100 01000100 00000100 | | N/A | |
| CCSI,1 |  | | 11111011 11111011 11111011 10111011 11111011 | | N/A | |
| Number of control OFDM symbols | | | |  | | 3 | | 3 | |
| PHICH Ng (Note 9) | | | |  | | 1 | | N/A | |
| PHICH duration | | | |  | | extended | | N/A | |
| Unused RE-s and PRB-s | | | |  | | OCNG | | OCNG | |
| Cyclic prefix | | | |  | | Normal | | Normal | |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS  Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26th subframe indicated by the ABS pattern.  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in the test  Note 9: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | | | |

Table 8.5.1.2.3-2: Minimum performance PHICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Antenna Configuration and Correlation Matrix | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-an (%) | SNR (dB) (Note 2) |
| 1 | R.19 | OP.1 FDD | OP.1 FDD | EPA5 | EPA5 | 2x2 Low | 0.1 | 4.6 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | |

### 8.5.2 TDD

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.5.2-1: Test Parameters for PHICH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |
| Uplink downlink configuration (Note 1) | |  | 1 | 1 |
| Special subframe configuration (Note 2) | |  | 4 | 4 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | 0 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | 0 | -3 |
| PHICH duration | |  | Normal | Normal |
| PHICH Ng (Note 3) | |  | Ng = 1 | Ng = 1 |
| PDCCH Content | |  | UL Grant should be included with the proper information aligned with A.3.6. | |
| Unused RE-s and PRB-s | |  | OCNG | OCNG |
| Cell ID | |  | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| Cyclic prefix | |  | Normal | Normal |
| ACK/NACK feedback mode | |  | Multiplexing | Multiplexing |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4]  Note 2: as specified in Table 4.2-1 in TS 36.211 [4]  Note 3: according to Clause 6.9 in TS 36.211 [4] | | | | |

#### 8.5.2.1 Single-antenna port performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.1-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 10 MHz | R.18 | OP.1 TDD | ETU70 | 1 x 2 Low | 0.1 | 5.8 |
| 2 | 10 MHz | R.24 | OP.1 TDD | ETU70 | 1 x 2 Low | 0.1 | 1.3 |

#### 8.5.2.2 Transmit diversity performance

##### 8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.1-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 10 MHz | R.19 | OP.1 TDD | EVA70 | 2 x 2 Low | 0.1 | 4.2 |

##### 8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.2-1: Minimum performance PHICH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-an (%) | SNR (dB) |
| 1 | 5 MHz | R.20 | OP.1 TDD | EPA5 | 4 x 2 Medium | 0.1 | 6.2 |

##### 8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.2.2.3-1: Test Parameters for PHICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | |
| at antenna port |  | | dBm/15kHz | | -100.5 (Note 1) | | N/A | |
|  | | dBm/15kHz | | -98 (Note 2) | | N/A | |
|  | | dBm/15kHz | | -95.3 (Note 3) | | N/A | |
|  | | | dB | | Reference Value in Table 8.5.2.2.3-2 | | 1.5 | |
| BWChannel | | | MHz | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | 2.5 (synchronous cells) | | | |
| Cell Id | | |  | | 0 | | 1 | |
| ABS pattern (Note 4) | | |  | | N/A | | 0000010001 0000000001 | |
| RLM/RRM Measurement Subframe Pattern (Note 5) | | |  | | 0000000001 0000000001 | | N/A | |
| CSI Subframe Sets (Note 6) | CCSI,0 | |  | | 0000010001 0000000001 | | N/A | |
| CCSI,1 | |  | | 1100101000 1100111000 | | N/A | |
| Number of control OFDM symbols | | |  | | 3 | | 3 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | |
| PHICH Ng (Note 9) | | |  | | 1 | | N/A | |
| PHICH duration | | |  | | extended | | N/A | |
| Unused RE-s and PRB-s | | |  | | OCNG | | OCNG | |
| Cyclic prefix | | |  | | Normal | | Normal | |
| Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS  Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]  Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 8: SIB-1 will not be transmitted in Cell2 in the test  Note 9: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | | |

Table 8.5.2.2.3-2: Minimum performance PHICH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Antenna Configuration and Correlation Matrix | Reference Value | |
| Cell 1 | Cell 2 | Cell 1 | Cell 2 | Pm-an (%) | SNR (dB) (Note 2) |
| 1 | R.19 | OP.1 TDD | OP.1 TDD | EPA5 | EPA5 | 2x2 Low | 0.1 | 4.6 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to of cell 1.  Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. | | | | | | | | |

## 8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch).

### 8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |  |
|  | |  |  |  |  |
| Downlink power allocation | PBCH\_RA | dB | 0 | -3 |  |
| PBCH\_RB | dB | 0 | -3 |  |
| at antenna port | | dBm/15kHz | -98 | -98 |  |
| Cyclic prefix | |  | Normal | Normal |  |
| Cell ID | |  | 0 | 0 |  |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4]  Note 2: as specified in Table 4.2-1 in TS 36.211 [4] | | | | | |

#### 8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.1-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.21 | ETU70 | 1 x 2 Low | 1 | -6.1 |

#### 8.6.1.2 Transmit diversity performance

##### 8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.1-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.22 | EPA5 | 2 x 2 Low | 1 | -4.8 |

##### 8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.2-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.23 | EVA5 | 4 x 2 Medium | 1 | -3.5 |

### 8.6.2 TDD

Table 8.6.2-1: Test Parameters for PBCH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Single antenna port | Transmit diversity |  |
| Uplink downlink configuration (Note 1) | |  | 1 | 1 |  |
| Special subframe configuration (Note 2) | |  | 4 | 4 |  |
|  | |  |  |  |  |
| Downlink power allocation | PBCH\_RA | dB | 0 | -3 |  |
| PBCH\_RB | dB | 0 | -3 |  |
| at antenna port | | dBm/15kHz | -98 | -98 |  |
| Cyclic prefix | |  | Normal | Normal |  |
| Cell ID | |  | 0 | 0 |  |
| Note 1: as specified in Table 4.2-2 in TS 36.211 [4].  Note 2: as specified in Table 4.2-1 in TS 36.211 [4]. | | | | | |

#### 8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.1-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.21 | ETU70 | 1 x 2 Low | 1 | -6.4 |

#### 8.6.2.2 Transmit diversity performance

##### 8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.1-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.22 | EPA5 | 2 x 2 Low | 1 | -4.8 |

##### 8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.2-1: Minimum performance PBCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-bch (%) | SNR (dB) |
| 1 | 1.4 MHz | R.23 | EVA5 | 4 x 2 Medium | 1 | -4.1 |

## 8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available.

### 8.7.1 FDD

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.7.1-1: Common Test Parameters (FDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Cyclic prefix | | |  | Normal | |
| Cell ID | | |  | 0 | |
| Inter-TTI Distance | | |  | 1 | |
| Number of HARQ processes per component carrier | | | Processes | 8 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | |  | Not configured | |

The requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.1-2: test parameters for sustained downlink data rate (FDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3,4,6 | Test 3A | Test 3B | Test 4A | Test 3C, 4B | Test 6A |
| Bandwidth | | MHz | 10 | 10 | 20 | 10 | 2x10 | 2x10 | 15 | 2x20 |
| Transmission mode | |  | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Antenna configuration | |  | 1 x 2 | 2 x 2 | 2 x 2 | 2 x 2 | 2x2 | 2x2 | 2 x 2 | 2 x 2 |
| Propagation condition | |  | Static propagation condition (Note 1) | | | | | | | |
| CodeBookSubsetRestriction bitmap | |  | n/a | 10 | 10 | 10 | 10 | 10 | **10** | 10 |
| Downlink power allocation |  | dB | 0 | -3 | -3 | -3 | -3 | -3 | **-3** | -3 |
|  | dB | 0 | -3 | -3 | -3 | -3 | -3 | **-3** | -3 |
| σ | dB | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 |
| at antenna port | | dBm/15kHz | -85 | -85 | -85 | -85 | -85 | -85 | **-85** | -85 |
| Symbols for unused PRBs | |  | OP.6 FDD | OP.1 FDD | OP.1 FDD | OP.1 FDD | OP.1 FDD | OP.1 FDD | OP.1 FDD | OP.1 FDD |
| Note 1: No external noise sources are applied.  Note 2: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK. | | | | | | | | | | |

Table 8.7.1-3: Minimum requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Number of bits of a DL-SCH transport block received within a TTI | Measurement channel | Reference value |
| TB success rate [%] |
| 1 | 10296 | R.31-1 FDD | 95 |
| 2 | 25456 | R.31-2 FDD | 95 |
| 3 | 51024 | R.31-3 FDD | 95 |
| 3A | 36696 (Note 2) | R.31-3A FDD | 85 |
| 3B | 25456 | R.31-2 FDD | 95 |
| 3C | 51024 | R.31-3C | 85 |
| 4 | 75376 (Note 3) | R.31-4 FDD | 85 |
| 4A | 36696 (Note 2) | R.31-3A FDD | 85 |
| 4B | 55056 (Note 5) | R.31-4B FDD | 85 |
| 6 | 75376 (Note 3) | R.31-4 FDD | 85 |
| 6A | 75376 (Note 3) | R.31-4 FDD | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: 35160 bits for sub-frame 5.  Note 3: 71112 bits for sub-frame 5.  Note 4: The TB success rate is defined as TB success rate = 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.  Note 5: 52752bits for sub-frame 5. | | | |

Table 8.7.1-4: Test points for sustained data rate (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | **Category 1** | **Category 2** | **Category 3** | **Category 4** | **Category 6** | **Category 7** |
| Single carrier | 10 | 1 | 2 | 3A | 3A | - | - |
| 15 | - | - | 3C | 4B | - | - |
| 20 | - | - | 3 | 4 | 6 | 6 |
| CA with 2CCs | 10+10 | - | - | 3B | 4A | 6A | 6A |
| 20+20 | - | - | 3 (Note 4) | 4 (Note 4) | 6A | 6A |
| Note 1: Void.  Note 2: For non-CA UE, test is selected for maximum supported bandwidth.  Note 3: Void.  Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single carrier test is selected, i.e., Test 3 for UE category 3 and Test 4 for UE category 4.  Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | |

### 8.7.2 TDD

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.2-1: Common Test Parameters (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
| Special subframe configuration (Note 1) | | |  | 4 | |
| Cyclic prefix | | |  | Normal | |
| Cell ID | | |  | 0 | |
| Inter-TTI Distance | | |  | 1 | |
| Maximum number of HARQ transmission | | |  | 4 | |
| Redundancy version coding sequence | | |  | {0,0,1,2} for 64QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | |  | Not configured | |
| Note 1: as specified in Table 4.2-1 in TS 36.211 [4]. | | | | | |

The requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.2-2: test parameters for sustained downlink data rate (TDD)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | Test 3A | Test 4,6 | Test 6A |
| Bandwidth | | MHz | 10 | 10 | 20 | 15 | 20 | 2x20 |
| Transmission mode | |  | 1 | 3 | 3 | 3 | 3 | 3 |
| Antenna configuration | |  | 1 x 2 | 2 x 2 | 2 x 2 | 2 x 2 | 2 x 2 | 2 x 2 |
| Propagation condition | |  | Static propagation condition (Note 1) | | | | | |
| CodeBookSubsetRestriction bitmap | |  | n/a | 10 | 10 | 10 | 10 | 10 |
| Downlink power allocation |  | dB | 0 | -3 | -3 | -3 | -3 | -3 |
|  | dB | 0 | -3 | -3 | -3 | -3 | -3 |
| σ | dB | 0 | 0 | 0 | 0 | 0 | 0 |
| at antenna port | | dBm/15kHz | -85 | -85 | -85 | -85 | -85 | -85 |
| Symbols for unused PRBs | |  | OP.6 TDD | OP.1 TDD | OP.1 TDD | OP.2 TDD | OP.1 TDD | OP.1 TDD |
| ACK/NACK feedback mode | |  | Bundling | Bundling | Bundling | Multiplexing | Multiplexing | -  (Note 2) |
| Note 1: No external noise sources are applied.  Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK. | | | | | | | | |

Table 8.7.2-3: Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Number of bits of a DL-SCH transport block received within a TTI for normal/special sub-frame | Measurement channel | Reference value |
| TB success rate [%] |
| 1 | 10296/0 | R31-1 TDD | 95 |
| 2 | 25456/0 | R31-2 TDD | 95 |
| 3 | 51024/0 | R31-3 TDD | 95 |
| 3A | 51024/0 | R31-3A TDD | 85 |
| 4 | 75376/0 (Note 2) | R31-4 TDD | 85 |
| 6 | 75376/0 (Note 2) | R.31-4 TDD | 85 |
| 6A | 75376/0 (Note 2) | R.31-4 TDD | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: 71112 bits for sub-frame 5.  Note 3: The TB success rate is defined as TB success rate = 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks. | | | |

Table 8.7.2-4: Test points for sustained data rate (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination**  **(MHz)** | **Category 1** | **Category 2** | **Category 3** | **Category 4** | **Category 6** | **Category 7** |
| Single carrier | 10 | 1 | 2 | - | - | - | - |
| 15 | - | - | 3A | 3A | - | - |
| 20 | - | - | 3 | 4 | 6 | 6 |
| CA with 2CCs | 20+20 |  | -- | 3 (Note 4) | 4 (Note 4) | 6A | 6A |
| Note 1: Void.  Note 2: For non-CA UE, test is selected for maximum supported bandwidth.  Note 3: Void.  Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, single carrier test is selected.  Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | |

# 9 Reporting of Channel State Information

## 9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section, the definition of SNR is in accordance with the one given in clause 8.1.1, where 

### 9.1.1 Applicability of requirements

#### 9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

#### 9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set. The definition of CA capability is specified in 8.1.2.2.

Table 9.1.1.2-1: Applicability and test rules for CA UE CQI tests with 2 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Tests | CA capability where the tests apply | CA configuration from the selected CA capbility where the tests apply | CA Bandwidth combination to be tested in priority order |
| CA tests with 2CCs in Clause 9.6.1.1 | Any of one of the supported CA capabilities | Any one of the supported FDD CA configurations | 10+10 MHz, 20+20 MHz |
| CA tests with 2CCs in Clause 9.6.1.2 | Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| Note 1: The applicability and test rules are specified in this table, unless otherwise stated.  Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is one. | | | |

## 9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

### 9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

#### 9.2.1.1 FDD

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD in Table A.4-1 shall be in the range of ±1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 1 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | | |
| SNR (Note 2) | | dB | 0 | 1 | 6 | 7 |
|  | | dB[mW/15kHz] | -98 | -97 | -92 | -91 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | | |
| PUCCH Report Type | |  | 4 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 6 | | | |
| Note 1: Reference measurement channel according RC.1 FDD to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. | | | | | | |

#### 9.2.1.2 TDD

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of ±1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 1 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | | |
| SNR (Note 2) | | dB | 0 | 1 | 6 | 7 |
|  | | dB[mW/15kHz] | -98 | -97 | -92 | -91 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI reporting | |  | PUSCH (Note 3) | | | |
| PUCCH Report Type | |  | 4 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2. | | | | | | |

#### 9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ±1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets CCSI,1 is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets CCSI,0 minus the median CQI obtained by reports in CSI subframe sets CCSI,1 shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.3-1: PUCCH 1-0 static test (FDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 | Cell 1 | | Cell 2 |
| Bandwidth | | | MHz | 10 | | | | 10 | | |
| PDSCH transmission mode | | |  | 2 | | Note 10 | | 2 | | Note 10 |
| Downlink power allocation | |  | dB | -3 | | | | -3 | | |
|  | dB | -3 | | | | -3 | | |
| σ | dB | 0 | | | | 0 | | |
| Propagation condition and antenna configuration | | |  | Clause B.1 (2x2) | | | | Clause B.1 (2x2) | | |
| (Note 1) | | | dB | 4 | 5 | | 6 | 4 | 5 | -12 |
| at antenna port |  | | dBm/15kHz | -102 (Note 7) | | | N/A | -98(Note 7) | | N/A |
|  | | dBm/15kHz | -98 (Note 8) | | | N/A | -98(Note 8) | | N/A |
|  | | dBm/15kHz | -94.8 (Note 9) | | | N/A | -98(Note 9) | | N/A |
|  | | | dB[mW/15kHz] | -94 | -93 | | -92 | -94 | -93 | -110 |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN |
| Cell Id | | |  | 0 | | | 1 | 0 | | 1 |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | | | | 2.5 (synchronous cells) | | |
| ABS pattern (Note 2) | | |  | N/A | | | 01010101  01010101  01010101  01010101  01010101 | N/A | | 01010101  01010101  01010101  01010101  01010101 |
| RLM/RRM Measurement Subframe Pattern (Note 4) | | |  | 00000100  00000100  00000100  00000100  00000100 | | | N/A | 00000100  00000100  00000100  00000100  00000100 | | N/A |
| CSI Subframe Sets (Note 3) | CCSI,0 | |  | 01010101  01010101  01010101  01010101  01010101 | | | N/A | 01010101  01010101  01010101  01010101  01010101 | | N/A |
| CCSI,1 | |  | 10101010  10101010  10101010  10101010  10101010 | | | N/A | 10101010  10101010  10101010  10101010  10101010 | | N/A |
| Number of control OFDM symbols | | |  | 3 | | | | 3 | | |
| Max number of HARQ transmissions | | |  | 1 | | | | 1 | | |
| Physical channel for CCSI,0 CQI reporting | | |  | PUCCH Format 2 | | | | PUCCH Format 2 | | |
| Physical channel for CCSI,1 CQI reporting | | |  | PUSCH (Note 12) | | | | PUSCH (Note 12) | | |
| PUCCH Report Type | | |  | 4 | | | | 4 | | |
| Reporting periodicity | | | Ms | *N*pd = 5 | | | | *N*pd = 5 | | |
| *cqi-pmi-ConfigurationIndex*  CCSI,0 (Note 13) | | |  | 6 | | N/A | | 6 | | N/A |
| *cqi-pmi-ConfigurationIndex2*  CCSI,1 (Note 14) | | | 5 | | N/A | | 5 | | N/A |
| Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 2: ABS pattern as defined in [9].  Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5  Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2.  Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.  Note 13: *cqi-pmi-ConfigurationIndex* is applied for CCSI,0.  Note 14: *cqi-pmi-ConfigurationIndex2* is applied for CCSI,1. | | | | | | | | | | |

#### 9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category 1-8. For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ±1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets CCSI,1 is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets CCSI,0 minus the median CQI obtained by reports in CSI subframe sets CCSI,1 shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 | Cell 1 | | Cell 2 |
| Bandwidth | | | MHz | 10 | | | | 10 | | |
| PDSCH transmission mode | | |  | 2 | | Note 10 | | 2 | | Note 10 |
| Uplink downlink configuration | | |  | 1 | | | | 1 | | |
| Special subframe configuration | | |  | 4 | | | | 4 | | |
| Downlink power allocation | |  | dB | -3 | | | | -3 | | |
|  | dB | -3 | | | | -3 | | |
| σ | dB | 0 | | | | 0 | | |
| Propagation condition and antenna configuration | | |  | Clause B.1 (2x2) | | | | Clause B.1 (2x2) | | |
| (Note 1) | | | dB | 4 | 5 | | 6 | 4 | 5 | -12 |
| at antenna port |  | | dBm/15kHz | -102(Note 7) | | | N/A | -98(Note 7) | | N/A |
|  | | dBm/15kHz | -98(Note 8) | | | N/A | -98(Note 8) | | N/A |
|  | | dBm/15kHz | -94.8(Note 9) | | | N/A | -98(Note 9) | | N/A |
|  | | | dB[mW/15kHz] | -94 | -93 | | -92 | -94 | -93 | -110 |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN |
| Cell Id | | |  | 0 | | | 1 | 0 | | 1 |
| Time Offset between Cells | | | μs | 2.5 (synchronous cells) | | | | 2.5 (synchronous cells) | | |
| ABS pattern (Note 2) | | |  | N/A | | | 0100010001  0100010001 | N/A | | 0100010001  0100010001 |
| RLM/RRM Measurement Subframe Pattern (Note 4) | | |  | 0000000001  0000000001 | | | N/A | 0000000001  0000000001 | | N/A |
| CSI Subframe Sets (Note 3) | CCSI,0 | |  | 0100010001  0100010001 | | | N/A | 0100010001  0100010001 | | N.A |
| CCSI,1 | |  | 1000101000  1000101000 | | | N/A | 1000101000  1000101000 | | N/A |
| Number of control OFDM symbols | | |  | 3 | | | | 3 | | |
| Max number of HARQ transmissions | | |  | 1 | | | | 1 | | |
| Physical channel for CCSI,0  CQI reporting | | |  | PUCCH Format 2 | | | | PUCCH Format 2 | | |
| Physical channel for CCSI,1 CQI reporting | | |  | PUSCH (Note 12) | | | | PUSCH (Note 12) | | |
| PUCCH Report Type | | |  | 4 | | | | 4 | | |
| Reporting periodicity | | | ms | *N*pd = 5 | | | | *N*pd = 5 | | |
| *cqi-pmi-ConfigurationIndex*  CCSI,0 (Note 13) | | |  | 3 | | N/A | | 3 | | N/A |
| *cqi-pmi-ConfigurationIndex*2 CCSI,1 (Note 14) | | | 4 | | N/A | | 4 | | N/A |
| ACK/NACK feedback mode | | |  | Multiplexing | | | | Multiplexing | | |
| Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 2: ABS pattern as defined in [9].  Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5  Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1 and Annex A.5.2.2.  Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.  Note 13: *cqi-pmi-ConfigurationIndex* is applied for CCSI,0.  Note 14: *cqi-pmi-ConfigurationIndex2* is applied for CCSI,1. | | | | | | | | | | |

### 9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.2.2.1 FDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI1 = wideband CQI0 – Codeword 1 offset level

The wideband CQI1 shall be within the set {median CQI1 -1, median CQI1, median CQI1 +1} for more than 90% of the time, where the resulting wideband values CQI1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 – 1 and median CQI1 – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 + 1 and median CQI1 + 1 shall be greater than or equal to 0.1.

Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 4 | | | |
| Downlink power allocation |  | dB | -3 | | | |
|  | dB | -3 | | | |
| σ | dB | 0 | | | |
| Propagation condition and antenna configuration | |  | Clause B.1 (2 x 2) | | | |
| CodeBookSubsetRestriction bitmap | |  | 010000 | | | |
| SNR (Note 2) | | dB | 10 | 11 | 16 | 17 |
|  | | dB[mW/15kHz] | -88 | -87 | -82 | -81 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI/PMI reporting | |  | PUCCH Format 2 | | | |
| PUCCH Report Type for CQI/PMI | |  | 2 | | | |
| PUCCH Report Type for RI | |  | 3 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 6 | | | |
| *ri-ConfigIndex* | |  | 1 (Note 3) | | | |
| Note 1: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test. | | | | | | |

#### 9.2.2.2 TDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI1 = wideband CQI0 – Co RC.2 TDD deword 1 offset level

The wideband CQI1 shall be within the set {median CQI1 -1, median CQI1, median CQI1 +1} for more than 90% of the time, where the resulting wideband values CQI1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 – 1 and median CQI1 – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 + 1 and median CQI1 + 1 shall be greater than or equal to 0.1.

Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 4 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Downlink power allocation |  | dB | -3 | | | |
|  | dB | -3 | | | |
| σ | dB | 0 | | | |
| Propagation condition and antenna configuration | |  | Clause B.1 (2 x 2) | | | |
| CodeBookSubsetRestriction bitmap | |  | 010000 | | | |
| SNR (Note 2) | | dB | 10 | 11 | 16 | 17 |
|  | | dB[mW/15kHz] | -88 | -87 | -82 | -81 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 3) | | | |
| PUCCH Report Type | |  | 2 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | | | |
| *ri-ConfigIndex* | |  | 805 (Note 4) | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.  Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification. | | | | | | |

### 9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.2.3.1 FDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI1 = wideband CQI0 – Codeword 1 offset level

The wideband CQI1 shall be within the set {median CQI1 -1, median CQI1, median CQI1 +1} for more than 90% of the time, where the resulting wideband values CQI1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 – 1 and median CQI1 – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 + 1 and median CQI1 + 1 shall be greater than or equal to 0.1.

Table 9.2.3.1-1: PUCCH 1-1 static test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 9 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -3 | | | |
| σ | dB | -3 | | | |
| Cell-specific reference signals | |  | Antenna ports 0, 1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,18 | | | |
| Beamforming model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | | |
| CSI reference signal configuration | |  | 0 | | | |
| Propagation condition and antenna configuration | |  | Clause B.1 (4 x 2) | | | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0100 0000 | | | |
| SNR (Note 2) | | dB | 7 | 8 | 13 | 14 |
|  | | dB[mW/15kHz] | -91 | -90 | -85 | -84 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note3) | | | |
| PUCCH Report Type for CQI/PMI | |  | 2 | | | |
| Physical channel for RI reporting | |  | PUCCH Format 2 | | | |
| PUCCH Report Type for RI | |  | 3 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| CQI delay | | ms | 8 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 2 | | | |
| *ri-ConfigIndex* | |  | 1 | | | |
| Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5. | | | | | | |

#### 9.2.3.2 TDD

The following requirements apply to UE Category 2-8. For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI1 = wideband CQI0 – Codeword 1 offset level

The wideband CQI1 shall be within the set {median CQI1 -1, median CQI1, median CQI1 +1} for more than 90% of the time, where the resulting wideband values CQI1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 – 1 and median CQI1 – 1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI0 + 1 and median CQI1 + 1 shall be greater than or equal to 0.1.

Table 9.2.3.2-1: PUCCH 1-1 submode 1 static test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 9 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -6 | | | |
| σ | dB | -3 | | | |
| CRS reference signals | |  | Antenna ports 0, 1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,22 | | | |
| Beamforming model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 3 | | | |
| CSI reference signal configuration | |  | 0 | | | |
| Propagation condition and antenna configuration | |  | Clause B.1 (8 x 2) | | | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0020 0000 0000 0001 0000 | | | |
| SNR (Note 2) | | dB | 4 | 5 | 10 | 11 |
|  | | dB[mW/15kHz] | -94 | -93 | -88 | -87 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 3) | | | |
| PUCCH Report Type for CQI/second PMI | |  | 2b | | | |
| Physical channel for RI reporting | |  | PUSCH | | | |
| PUCCH Report Type for RI/ first PMI | |  | 5 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| CQI delay | | ms | 10 or 11 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | | | |
| *ri-ConfigIndex* | |  | 805 (Note 4) | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.  Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification. | | | | | | |

## 9.3 CQI reporting under fading conditions

### 9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

##### 9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least ** % of the time but less than **% for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 10 MHz | | | |
| Transmission mode | | |  | 1 (port 0) | | | |
| Downlink power allocation | |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | | dB | 9 | 10 | 14 | 15 |
|  | | | dB[mW/15kHz] | -89 | -88 | -84 | -83 |
|  | | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Antenna configuration | | |  | 1 x 2 | | | |
| Reporting interval | | | ms | 5 | | | |
| CQI delay | | | ms | 8 | | | |
| Reporting mode | | |  | PUSCH 3-0 | | | |
| Sub-band size | | | RB | 6 (full size) | | | |
| Max number of HARQ transmissions | | |  | 1 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. | | | | | | | |

Table 9.3.1.1.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| UE Category | 1-8 | 1-8 |

##### 9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least ** % of the time but less than **% for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | Test 1 | | | Test 2 | |
| Bandwidth | | | | MHz | | 10 MHz | | | | |
| Transmission mode | | | |  | | 1 (port 0) | | | | |
| Downlink power allocation | | |  | dB | | 0 | | | | |
|  | dB | | 0 | | | | |
| σ | dB | | 0 | | | | |
| Uplink downlink configuration | | | |  | | 2 | | | | |
| Special subframe configuration | | | |  | | 4 | | | | |
| SNR (Note 3) | | | | dB | | 9 | | 10 | 14 | 15 |
|  | | | | dB[mW/15kHz] | | -89 | | -88 | -84 | -83 |
|  | | | | dB[mW/15kHz] | | -98 | | | -98 | |
| Propagation channel | | | |  | | Clause B.2.4 with **s, *a* = 1, Hz | | | | |
| Antenna configuration | | | |  | | 1 x 2 | | | | |
| Reporting interval | | | | ms | | 5 | | | | |
| CQI delay | | | | ms | | 10 or 11 | | | | |
| Reporting mode | | | |  | | PUSCH 3-0 | | | | |
| Sub-band size | | | | RB | | 6 (full size) | | | | |
| Max number of HARQ transmissions | | | |  | | 1 | | | | |
| ACK/NACK feedback mode | | | |  | | Multiplexing | | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. | | | | | | | | | | |

Table 9.3.1.1.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| UE Category | 1-8 | 1-8 |

#### 9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

##### 9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least ** % of the time but less than **% for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.1-1 Sub-band test for FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 9 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | dB | 4 | 5 | 11 | 12 |
|  | | dB[mW/15kHz] | -94 | -93 | -87 | -86 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Antenna configuration | |  | 2x2 | | | |
| CRS reference signals | |  | Antenna ports 0 | | | |
| CSI reference signals | |  | Antenna ports 15, 16 | | | |
| Beamforming model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 1 | | | |
| CSI-RS reference signal configuration | |  | 4 | | | |
| CodeBookSubsetRestriction bitmap | |  | 000001 | | | |
| Reporting interval (Note 4) | | ms | 5 | | | |
| CQI delay | | ms | 8 | | | |
| Reporting mode | |  | PUSCH 3-1 | | | |
| Sub-band size | | RB | 6 (full size) | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.8 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5. | | | | | | |

Table 9.3.1.2.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 40 | 40 |
| ** | 1.1 | 1.1 |
| UE Category | 1-8 | 1-8 |

##### 9.3.1.2.2 TDD

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least ** % of the time but less than **% for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.2-1 Sub-band test for TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 9 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | dB | 4 | 5 | 11 | 12 |
|  | | dB[mW/15kHz] | -94 | -93 | -87 | -86 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Antenna configuration | |  | 2x2 | | | |
| CRS reference signals | |  | Antenna port 0 | | | |
| CSI reference signals | |  | Antenna port 15,16 | | | |
| Beamforming model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 3 | | | |
| CSI-RS reference signal configuration | |  | 4 | | | |
| CodeBookSubsetRestriction bitmap | |  | 000001 | | | |
| Reporting interval (Note 4) | | ms | 5 | | | |
| CQI delay | | ms | 10 | | | |
| Reporting mode | |  | PUSCH 3-1 | | | |
| Sub-band size | | RB | 6 (full size) | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.8 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7. | | | | | | |

Table 9.3.1.2.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 40 | 40 |
| ** | 1.1 | 1.1 |
| UE Category | 1-8 | 1-8 |

### 9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

##### 9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least ** % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ **;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

Table 9.3.2.1.1-1 Fading test for single antenna (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | dB | 6 | 7 | 12 | 13 |
|  | | dB[mW/15kHz] | -92 | -91 | -86 | -85 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA5 | | | |
| Correlation and antenna configuration | |  | High (1 x 2) | | | |
| Reporting mode | |  | PUCCH 1-0 | | | |
| Reporting periodicity | | ms | *N*pd = 2 | | | |
| CQI delay | | ms | 8 | | | |
| Physical channel for CQI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type | |  | 4 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 1 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3. | | | | | | |

Table 9.3.2.1.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |
| UE Category | 1-8 | 1-8 |

##### 9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least ** % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ **;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| SNR (Note 3) | | dB | 6 | 7 | 12 | 13 |
|  | | dB[mW/15kHz] | -92 | -91 | -86 | -85 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA5 | | | |
| Correlation and antenna configuration | |  | High (1 x 2) | | | |
| Reporting mode | |  | PUCCH 1-0 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| CQI delay | | ms | 10 or 11 | | | |
| Physical channel for CQI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type | |  | 4 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2. | | | | | | |

Table 9.3.2.1.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |
| UE Category | 1-8 | 1-8 |

#### 9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

##### 9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least ** % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ **;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.1-1 Fading test for FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 9 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -3 | | | |
| σ | dB | -3 | | | |
| SNR (Note 3) | | dB | 2 | 3 | 7 | 8 |
|  | | dB[mW/15kHz] | -96 | -95 | -91 | -90 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA5 | | | |
| Correlation and antenna configuration | |  | ULA High (4 x 2) | | | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,18 | | | |
| Beamforming model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | | |
| CSI-RS reference signal configuration | |  | 2 | | | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 0001 | | | |
| Reporting mode | |  | PUCCH 1-1 | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| CQI delay | | ms | 8 | | | |
| Physical channel for CQI/ PMI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type for CQI/PMI | |  | 2 | | | |
| PUCCH channel for RI reporting | |  | PUCCH Format 2 | | | |
| PUCCH report type for RI | |  | 3 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 2 | | | |
| *ri-ConfigIndex* | |  | 1 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5. | | | | | | |

Table 9.3.2.2.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |
| UE Category | 2-8 | 2-8 |

##### 9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least ** % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ **;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.2-1 Fading test for TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 9 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -6 | | | |
| σ | dB | -3 | | | |
| SNR (Note 3) | | dB | 1 | 2 | 7 | 8 |
|  | | dB[mW/15kHz] | -97 | -96 | -91 | -90 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA5 | | | |
| Correlation and antenna configuration | |  | XP High (8 x 2) | | | |
| CRS reference signals | |  | Antenna ports 0, 1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,22 | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 3 | | | |
| CSI-RS reference signal configuration | |  | 2 | | | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 0020 0000 0000 0001 | | | |
| Reporting mode | |  | PUCCH 1-1 (Sub-mode: 2) | | | |
| Reporting periodicity | | ms | *N*pd = 5 | | | |
| CQI delay | | ms | 10 | | | |
| Physical channel for CQI/ PMI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type for CQI/ PMI | |  | 2c | | | |
| Physical channel for RI reporting | |  | PUCCH Format 2 | | | |
| PUCCH report type for RI | |  | 3 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | | | |
| *ri-ConfigIndex* | |  | 805 (Note 5) | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.  Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available. | | | | | | |

Table 9.3.2.2.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |
| UE Category | 2-8 | 2-8 |

### 9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

#### 9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

##### 9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least ** % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 |
| Bandwidth | | MHz | 10 MHz | 10 MHz |
| Transmission mode | |  | 1 (port 0) | 1 (port 0) |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 | 0 |
| σ | dB | 0 | 0 |
| for RB 0…5 | | dB[mW/15kHz] | -102 | -93 |
| for RB 6…41 | | dB[mW/15kHz] | -93 | -93 |
| for RB 42…49 | | dB[mW/15kHz] | -93 | -102 |
|  | | dB[mW/15kHz] | -94 | -94 |
| Max number of HARQ transmissions | |  | 1 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | |
| Reporting interval | | ms | 5 | |
| Antenna configuration | |  | 1 x 2 | |
| CQI delay | | ms | 8 | |
| Reporting mode | |  | PUSCH 3-0 | |
| Sub-band size | | RB | 6 (full size) | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2. | | | | |

Table 9.3.3.1.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 60 | 60 |
| ** | 1.6 | 1.6 |
| UE Category | 1-8 | 1-8 |

##### 9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least ** % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be ≥ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Test 1 | Test 2 | |
| Bandwidth | | | MHz | | 10 MHz | 10 MHz | |
| Transmission mode | | |  | | 1 (port 0) | 1 (port 0) | |
| Downlink power allocation |  | | dB | | 0 | 0 | |
|  | | dB | | 0 | 0 | |
| σ | | dB | | 0 | 0 | |
| Uplink downlink configuration | | |  | | 2 | | |
| Special subframe configuration | | |  | | 4 | | |
| for RB 0…5 | | | dB[mW/15kHz] | | -102 | -93 | |
| for RB 6…41 | | | dB[mW/15kHz] | | -93 | -93 | |
| for RB 42…49 | | | dB[mW/15kHz] | | -93 | -102 | |
|  | | | dB[mW/15kHz] | | -94 | -94 | |
| Max number of HARQ transmissions | | |  | | 1 | | |
| Propagation channel | | |  | | Clause B.2.4 with **s, *a* = 1, Hz | | |
| Antenna configuration | | |  | | 1 x 2 | | |
| Reporting interval | | | ms | | 5 | | |
| CQI delay | | | ms | | 10 or 11 | | |
| Reporting mode | | |  | | PUSCH 3-0 | | |
| Sub-band size | | | RB | | 6 (full size) | | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2. | | | | | | | |

Table 9.3.3.1.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 60 | 60 |
| ** | 1.6 | 1.6 |
| UE Category | 1-8 | 1-8 |

#### 9.3.3.2 Void

##### 9.3.3.2.1 Void

##### 9.3.3.2.2 Void

### 9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

##### 9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be ≥ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and theentry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | dB | 9 | 10 | 14 | 15 |
|  | | dB[mW/15kHz] | -89 | -88 | -84 | -83 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Reporting interval | | ms | 5 | | | |
| CQI delay | | ms | 8 | | | |
| Reporting mode | |  | PUSCH 2-0 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Subband size (*k*) | | RBs | 3 (full size) | | | |
| Number of preferred subbands (*M*) | |  | 5 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.5 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. | | | | | | |

Table 9.3.4.1.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** | 1.2 | 1.2 |
| UE Category | 1-8 | 1-8 |

##### 9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be ≥ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and theentry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| SNR (Note 3) | | dB | 9 | 10 | 14 | 15 |
|  | | dB[mW/15kHz] | -89 | -88 | -84 | -83 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Reporting interval | | ms | 5 | | | |
| CQI delay | | ms | 10 or 11 | | | |
| Reporting mode | |  | PUSCH 2-0 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Subband size (*k*) | | RBs | 3 (full size) | | | |
| Number of preferred subbands (*M*) | |  | 5 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.5 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. | | | | | | |

Table 9.3.4.1.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** | 1.2 | 1.2 |
| UE Category | 1-8 | 1-8 |

#### 9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

##### 9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be ≥ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and theentry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| SNR (Note 3) | | dB | 8 | 9 | 13 | 14 |
|  | | dB[mW/15kHz] | -90 | -89 | -85 | -84 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Reporting periodicity | | ms | *N*P = 2 | | | |
| CQI delay | | ms | 8 | | | |
| Physical channel for CQI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type for wideband CQI | |  | 4 | | | |
| PUCCH Report Type for subband CQI | |  | 1 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Subband size (*k*) | | RBs | 6 (full size) | | | |
| Number of bandwidth parts (*J*) | |  | 3 | | | |
| K | |  | 1 | | | |
| *cqi-pmi-ConfigIndex* | |  | 1 | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)  Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.  Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.  Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI report. | | | | | | |

Table 9.3.4.2.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** | 1.15 | 1.15 |
| UE Category | 1-8 | 1-8 |

##### 9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be ≥ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and theentry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10 MHz | | | |
| Transmission mode | |  | 1 (port 0) | | | |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| σ | dB | 0 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| SNR (Note 3) | | dB | 8 | 9 | 13 | 14 |
|  | | dB[mW/15kHz] | -90 | -89 | -85 | -84 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | | | |
| Reporting periodicity | | ms | *N*P = 5 | | | |
| CQI delay | | ms | 10 or 11 | | | |
| Physical channel for CQI reporting | |  | PUSCH (Note 4) | | | |
| PUCCH Report Type for wideband CQI | |  | 4 | | | |
| PUCCH Report Type for subband CQI | |  | 1 | | | |
| Max number of HARQ transmissions | |  | 1 | | | |
| Subband size (*k*) | | RBs | 6 (full size) | | | |
| Number of bandwidth parts (*J*) | |  | 3 | | | |
| K | |  | 1 | | | |
| *cqi-pmi-ConfigIndex* | |  | 3 | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.  Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.  Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part with j=1.  Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI report. | | | | | | |

Table 9.3.4.2.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** | 1.15 | 1.15 |
| UE Category | 1-8 | 1-8 |

## 9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6 and transmission mode 9 with 4 TX are specified in terms of the ratio

.

In the definition of *γ*, for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  is 60% of the maximum throughput obtained at using random precoding, and  the throughput measured at with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement, is 60% of the maximum throughput obtained at  using random precoding on a randomly selected full-size subband in set S subbands, and the throughput measured at with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements, is 60% of the maximum throughput obtained at  using random precoding on a randomly selected full-size subband in set S subbands, and the throughput measured at with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio



In the definition of *γ*, for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements, is 70% of the maximum throughput obtained at  using the precoders configured according to the UE reports, and is the throughput measured at with random precoding .

### 9.4.1 Single PMI

#### 9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

##### 9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

Table 9.4.1.1.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Propagation channel | |  | EVA5 |
| Precoding granularity | | PRB | 50 |
| Correlation and antenna configuration | |  | Low 2 x 2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 3-1 |
| Reporting interval | | ms | 1 |
| PMI delay (Note 2) | | ms | 8 |
| Measurement channel | |  | R. 10 FDD |
| OCNG Pattern | |  | OP.1 FDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | |

Table 9.4.1.1.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.1 |
| UE Category | 1-8 |

##### 9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

Table 9.4.1.1.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EVA5 |
| Precoding granularity | | PRB | 50 |
| Correlation and antenna configuration | |  | Low 2 x 2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 3-1 |
| Reporting interval | | ms | 1 |
| PMI delay (Note 2) | | ms | 10 or 11 |
| Measurement channel | |  | R.10 TDD |
| OCNG Pattern | |  | OP.1 TDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | |

Table 9.4.1.1.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.1 |
| UE Category | 1-8 |

#### 9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

##### 9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

Table 9.4.1.2.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Propagation channel | |  | EVA5 |
| Correlation and antenna configuration | |  | Low 4 x 2 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 |
| σ | dB | 3 |
|  | | dB[mW/15kHz] | -98 |
| PMI delay | | ms | 8 or 9 |
| Reporting mode | |  | PUCCH 2-1 (Note 6) |
| Reporting periodicity | | ms | *N*pd = 2 |
| Physical channel for CQI reporting | |  | PUSCH (Note 3) |
| PUCCH Report Type for wideband CQI/PMI | |  | 2 |
| PUCCH Report Type for subband CQI | |  | 1 |
| Measurement channel | |  | R.14-1 FDD |
| OCNG Pattern | |  | OP.1/2 FDD |
| Precoding granularity | | PRB | 6 (full size) |
| Number of bandwidth parts (*J*) | |  | 3 |
| K | |  | 1 |
| *cqi-pmi-ConfigIndex* | |  | 1 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoder shall be updated every two TTI (2 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI or subband CQI, it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.  Note 4: Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.  Note 5: In the case where wideband PMI is reported, data is to be transmitted on the most recently used subband.  Note 6: The bit field for PMI confirmation in DCI format 1B shall be mapped to “0” and TPMI information shall indicate the codebook index used in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI report on PUCCH. | | | |

Table 9.4.1.2.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | Test 1 |
| ** | 1.2 |
| UE Category | 1-8 |

##### 9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

Table 9.4.1.2.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EVA5 |
| Correlation and antenna configuration | |  | Low 4 x 2 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 |
| σ | dB | 3 |
|  | | dB[mW/15kHz] | -98 |
| PMI delay | | ms | 10 |
| Reporting mode | |  | PUCCH 2-1 (Note 6) |
| Reporting periodicity | | ms | *N*P = 5 |
| Physical channel for CQI reporting | |  | PUSCH (Note 3) |
| PUCCH Report Type for wideband CQI/PMI | |  | 2 |
| PUCCH Report Type for subband CQI | |  | 1 |
| Measurement channel | |  | R.14-1 TDD |
| OCNG Pattern | |  | OP.1/2 TDD |
| Precoding granularity | | PRB | 6 (full size) |
| Number of bandwidth parts (*J*) | |  | 3 |
| K | |  | 1 |
| *cqi-pmi-ConfigIndex* | |  | 4 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK fedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI or subband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.  Note 4: Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.  Note 5: In the case where wideband PMI is reported, data is to be transmitted on the most recently used subband.  Note 6: The bit field for PMI confirmation in DCI format 1B shall be mapped to “0” and TPMI information shall indicate the codebook index used in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI report on PUCCH. | | | |

Table 9.4.1.2.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test 1 |
| ** | 1.2 |
| UE Category | 1-8 |

#### 9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

##### 9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

Table 9.4.1.3.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Propagation channel | |  | EPA5 |
| Precoding granularity | | PRB | 50 |
| Correlation and antenna configuration | |  | Low  ULA 4 x 2 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| Beamforming model | |  | Annex B.4.3 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/ 1 |
| CSI-RS reference signal configuration | |  | 6 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 FFFF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 3-1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 8 |
| Measurement channel | |  | R.44 FDD |
| OCNG Pattern | |  | OP.1 FDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: PDSCH \_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver. | | | |

Table 9.4.1.3.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.2 |
| UE Category | 1-8 |

##### 9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

Table 9.4.1.3.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EVA5 |
| Precoding granularity | | PRB | 50 |
| Antenna configuration | |  | 8 x 2 |
| Correlation modeling | |  | High, Cross polarized |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,22 |
| Beamforming model | |  | Annex B.4.3 |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 4 |
| CSI-RS reference signal configuration | |  | 0 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 001F FFE0 0000 0000 FFFF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -6 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 3-1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 10 |
| Measurement channel | |  | R.45-1 TDD for UE Category 1, R.45 TDD for UE Category 2-8 |
| OCNG Pattern | |  | OP.7 TDD for UE Category 1, OP.1 TDD for UE Category 2-8 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.  Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4 | | | |

Table 9.4.1.3.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 3 |
| UE Category | 1-8 |

### 9.4.1a Void

#### 9.4.1a.1 Void

##### 9.4.1a.1.1 Void

### 9.4.1a.1.2 Void

### 9.4.2 Multiple PMI

#### 9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

##### 9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

Table 9.4.2.1.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Propagation channel | |  | EPA5 |
| Precoding granularity (only for reporting and following PMI) | | PRB | 6 |
| Correlation and antenna configuration | |  | Low 2 x 2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 1-2 |
| Reporting interval | | ms | 1 |
| PMI delay | | ms | 8 |
| Measurement channel | |  | R.11-3 FDD for UE Category 1, R.11 FDD for UE Category 2-8 |
| OCNG Pattern | |  | OP.1/2 FDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2 shall be used. | | | |

Table 9.4.2.1.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.2 |
| UE Category | 1-8 |

##### 9.4.2.1.2 TDD

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

Table 9.4.2.1.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EPA5 |
| Precoding granularity (only for reporting and following PMI) | | PRB | 6 |
| Correlation and antenna configuration | |  | Low 2 x 2 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 1-2 |
| Reporting interval | | ms | 1 |
| PMI delay | | ms | 10 or 11 |
| Measurement channel | |  | R.11-3 TDD for UE Category 1 R.11 TDD for UE Category 2-8 |
| OCNG Pattern | |  | OP.1/2 TDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be used. | | | |

Table 9.4.2.1.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.2 |
| UE Category | 1-8 |

#### 9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

##### 9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

Table 9.4.2.2.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Propagation channel | |  | EVA5 |
| Correlation and antenna configuration | |  | Low 4 x 2 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 |
| σ | dB | 3 |
|  | | dB[mW/15kHz] | -98 |
| PMI delay | | ms | 8 |
| Reporting mode | |  | PUSCH 2-2 |
| Reporting interval | | ms | 1 |
| Measurement channel | |  | R.14-2 FDD |
| OCNG Pattern | |  | OP.1/2 FDD |
| Subband size (*k*) | | RBs | 3 (full size) |
| Number of preferred subbands (*M*) | |  | 5 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4) | | | |

Table 9.4.2.2.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | Test 1 |
| ** | 1.2 |
| UE Category | 1-8 |

##### 9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

Table 9.4.2.2.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 6 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EVA5 |
| Correlation and antenna configuration | |  | Low 4 x 2 |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 |
| σ | dB | 3 |
|  | | dB[mW/15kHz] | -98 |
| PMI delay | | ms | 10 |
| Reporting mode | |  | PUSCH 2-2 |
| Reporting interval | | ms | 1 |
| Measurement channel | |  | R.14-2 TDD |
| OCNG Pattern | |  | OP.1/2 TDD |
| Subband size (*k*) | | RBs | 3 (full size) |
| Number of preferred subbands (*M*) | |  | 5 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). | | | |

Table 9.4.2.2.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test 1 |
| ** | 1.15 |
| UE Category | 1-8 |

#### 9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

##### 9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

Table 9.4.2.3.1-1 PMI test for single-layer (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Propagation channel | |  | EVA5 |
| Precoding granularity (only for reporting and following PMI) | | PRB | 6 |
| Correlation and antenna configuration | |  | Low  ULA 4 x 2 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| Beamforming model | |  | Annex B.4.3 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/ 1 |
| CSI-RS reference signal configuration | |  | 8 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 FFFF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 1-2 |
| Reporting interval | | ms | 5 |
| PMI delay | | ms | 8 |
| Measurement channel | |  | R.45-1 FDD for UE Category 1, R.45 FDD for UE Category 2-8 |
| OCNG Pattern | |  | OP.7 FDD for UE Category 1  OP.1 FDD for UE Category 2-8 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: Void.  Note 4: PDSCH \_RA= 0 dB, PDSCH\_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver. | | | |

Table 9.4.2.3.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.3 |
| UE Category | 1-8 |

##### 9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

Table 9.4.2.3.2-1 PMI test for single-layer (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Transmission mode | |  | 9 |
| Uplink downlink configuration | |  | 1 |
| Special subframe configuration | |  | 4 |
| Propagation channel | |  | EVA5 |
| Precoding granularity (only for reporting and following PMI) | | PRB | 6 |
| Antenna configuration | |  | 8 x 2 |
| Correlation modeling | |  | High, Cross polarized |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,22 |
| Beamforming model | |  | Annex B.4.3 |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 4 |
| CSI-RS reference signal configuration | |  | 4 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 001F FFE0 0000 0000 FFFF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | db | -6 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH 1-2 |
| Reporting interval | | ms | 5 (Note 4) |
| PMI delay | | ms | 10 |
| Measurement channel | |  | R.45-1 TDD for UE Category 1, R.45 TDD for UE Category 2-8 |
| OCNG Pattern | |  | OP.7 TDD for UE Category 1  OP.1 TDD for UE Category 2-8 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).  Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).  Note 3: Void.  Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.  Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4. | | | |

Table 9.4.2.3.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 3.5 |
| UE Category | 1-8 |

### 9.4.3 Void

#### 9.4.3.1 Void

##### 9.4.3.1.1 Void

##### 9.4.3.1.2 Void

## 9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3.

For fixed rank 1 transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

### 9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

#### 9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

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

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

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

Table 9.5.1.1-1 RI Test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | |
| Bandwidth | | MHz | 10 | | | |
| PDSCH transmission mode | |  | 4 | | | |
| Downlink power allocation |  | dB | -3 | | | |
|  | dB | -3 | | | |
| σ | dB | 0 | | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | | |
| CodeBookSubsetRestriction bitmap | |  | 000011 for fixed RI = 1  010000 for fixed RI = 2  010011 for UE reported RI | | | |
| Antenna correlation | |  | Low | Low | High | |
| RI configuration | |  | Fixed RI=2 and follow RI | Fixed RI=1 and follow RI | Fixed RI=1 and follow RI | Fixed RI=2 and follow RI |
| SNR | | dB | 0 | 20 | 20 | 20 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 | -98 |
|  | | dB[mW/15kHz] | -98 | -78 | -78 | -78 |
| Maximum number of HARQ transmissions | |  | 1 | | | |
| Reporting mode | |  | PUCCH 1-1 (Note 4) | | | |
| Physical channel for CQI/PMI reporting | |  | PUCCH Format 2 | | | |
| PUCCH Report Type for CQI/PMI | |  | 2 | | | |
| Physical channel for RI reporting | |  | PUSCH (Note 3) | | | |
| PUCCH Report Type for RI | |  | 3 | | | |
| Reporting periodicity | | ms | *N*pd= 5 | | | |
| PMI and CQI delay | | ms | 8 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 6 | | | |
| *ri-ConfigurationInd* | |  | 1 (Note 5) | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.  Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:  ● For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1  ● For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2  ● For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0  Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports. | | | | | | |

Table 9.5.1.1-2 Minimum requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 0.9 (Note 1) |
| **2 | 1 | N/A | 1.1 (Note 1) |
| UE Category | 2-8 | 2-8 | 2-8 |
| Note 1: For Test 3, the minimum requirements shall be fulfilled for at least one of **1 or **2 . | | | |

#### 9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

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

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

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

Table 9.5.1.2-1 RI Test (TDD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 | | |
| Bandwidth | | MHz | 10 | | | | |
| PDSCH transmission mode | |  | 4 | | | | |
| Downlink power allocation |  | dB | -3 | | | | |
|  | dB | -3 | | | |
| σ | dB | 0 | | | |
| Uplink downlink configuration | |  | 2 | | | | |
| Special subframe configuration | |  | 4 | | | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | | | |
| CodeBookSubsetRestriction bitmap | |  | 000011 for fixed RI = 1  010000 for fixed RI = 2  010011 for UE reported RI | | | | |
| Antenna correlation | |  | Low | Low | High | | |
| RI configuration | |  | Fixed RI=2 and follow RI | Fixed RI=1 and follow RI | Fixed RI=1 and follow RI | Fixed RI=2 and follow RI | |
| SNR | | dB | 0 | 20 | 20 | 20 | |
|  | | dB[mW/15kHz] | -98 | -98 | -98 | -98 | |
|  | | dB[mW/15kHz] | -98 | -78 | -78 | -78 | |
| Maximum number of HARQ transmissions | |  | 1 | | | | |
| Reporting mode | |  | PUSCH 3-1 (Note 3) | | | | |
| Reporting interval | | ms | 5 | | | | |
| PMI and CQI delay | | ms | 10 or 11 | | | | |
| ACK/NACK feedback mode | |  | Bundling | | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded. | | | | | | | |

Table 9.5.1.2-2 Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 0.9 (Note 1) |
| **2 | 1 | N/A | 1.1 (Note 1) |
| UE Category | 2-8 | 2-8 | 2-8 |
| Note 1: For Test 3, the minimum requirements shall be fulfilled for at least one of **1 or **2 . | | | |

### 9.5.2 Minimum requirement (CSI Reference Symbols)

#### 9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

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

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

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

Table 9.5.2.1-1 RI Test (FDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 |
| Bandwidth | | MHz | 10 | | |
| PDSCH transmission mode | |  | 9 | | |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Pc | dB | 0 | | |
| σ | dB | 0 | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | |
| Cell-specific reference signals | |  | Antenna ports 0 | | |
| CSI reference signals | |  | Antenna ports 15, 16 | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | |
| CSI reference signal configuration | |  | 6 | | |
| CodeBookSubsetRestriction bitmap | |  | 000011 for fixed RI = 1  010000 for fixed RI = 2  010011 for UE reported RI | | |
| Antenna correlation | |  | Low | Low | High |
| RI configuration | |  | Fixed RI=2 and follow RI | Fixed RI=1 and follow RI | Fixed RI=1 and follow RI |
| SNR | | dB | 0 | 20 | 20 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
|  | | dB[mW/15kHz] | -98 | -78 | -78 |
| Maximum number of HARQ transmissions | |  | 1 | | |
| Reporting mode | |  | PUCCH 1-1 | | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 3) | | |
| PUCCH Report Type for CQI/PMI | |  | 2 | | |
| Physical channel for RI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type for RI | |  | 3 | | |
| Reporting periodicity | | ms | *N*pd = 5 | | |
| PMI and CQI delay | | ms | 8 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 2 | | |
| *ri-ConfigurationInd* | |  | 1 (Note 4) | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.  Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports. | | | | | |

Table 9.5.2.1-2 Minimum requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1 | N/A | N/A |
| UE Category | 2-8 | 2-8 | 2-8 |

#### 9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

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

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

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

Table 9.5.2.2-1 RI Test (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 | Test 3 |
| Bandwidth | | MHz | 10 | | |
| PDSCH transmission mode | |  | 9 | | |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Pc | dB | 0 | | |
| σ | dB | 0 | | |
| Uplink downlink configuration | |  | 1 | | |
| Special subframe configuration | |  | 4 | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | |
| Cell-specific reference signals | |  | Antenna ports 0 | | |
| CSI reference signals | |  | Antenna ports 15, 16 | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | |
| CSI reference signal configuration | |  | 4 | | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/4 | | |
| CodeBookSubsetRestriction bitmap | |  | 000011 for fixed RI = 1  010000 for fixed RI = 2  010011 for UE reported RI | | |
| Antenna correlation | |  | Low | Low | High |
| RI configuration | |  | Fixed RI=2 and follow RI | Fixed RI=1 and follow RI | Fixed RI=1 and follow RI |
| SNR | | dB | 0 | 20 | 20 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
|  | | dB[mW/15kHz] | -98 | -78 | -78 |
| Maximum number of HARQ transmissions | |  | 1 | | |
| Reporting mode | |  | PUCCH 1-1 | | |
| Physical channel for CQI/ PMI reporting | |  | PUSCH (Note 3) | | |
| PUCCH report type for CQI/ PMI | |  | 2 | | |
| Physical channel for RI reporting | |  | PUCCH Format 2 | | |
| Reporting periodicity | | ms | *N*pd = 5 | | |
| PMI and CQI delay | | ms | 10 | | |
| ACK/NACK feedback mode | |  | Bundling | | |
| *cqi-pmi-ConfigurationIndex* | |  | 4 | | |
| *ri-ConfigurationInd* | |  | 1 | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.9 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8. | | | | | |

Table 9.5.2.2-2 Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1 | N/A | N/A |
| UE Category | 2-8 | 2-8 | 2-8 |

### 9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

#### 9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ γ1

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

Table 9.5.3.1-1 RI Test (FDD)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | Test 2 | | |
| Cell 1 | | Cell 2 | Cell 1 | Cell 2 | |
| Bandwidth | | MHz | 10 | | | 10 | | |
| PDSCH transmission mode | |  | 3 | | Note 10 | 3 | Note 10 | |
| Downlink power allocation |  | dB | -3 | | | -3 | | |
|  | dB | -3 | | | -3 | | |
| σ | dB | 0 | | | 0 | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | | 2 x 2 EPA5 | | |
| CodeBookSubsetRestriction bitmap | |  | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | | N/A | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | N/A | |
| Antenna correlation | |  | Low | | | Low | | |
| RI configuration | |  | Fixed RI=1 and follow RI | | N/A | Fixed RI=1 and follow RI | N/A | |
|  | | dB | 0 | | -12 | 20 | 6 | |
|  |  | dBmW/15kHz | -98 (Note 3) | | N/A | -102 (Note 3) | N/A | |
|  | -98 (Note 4) | | N/A | -98 (Note 4) | N/A | |
|  | -98 (Note 5) | | N/A | -94.8 (Note 5) | N/A | |
|  | | dB[mW/15kHz] | -98 | | -110 | -78 | -92 | |
| Subframe Configuration | |  | Non-MBSFN | | Non-MBSFN | Non-MBSFN | Non-MBSFN | |
| Cell Id | |  | 0 | | 1 | 0 | 1 | |
| Time Offset between Cells | | μs | 2.5 (synchronous cells) | | | 2.5 (synchronous cells) | | |
| ABS Pattern (Note 6) | |  | N/A | | 10000000  10000000  10000000  10000000  10000000 | N/A | 10000000  10000000  10000000  10000000  10000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 7) | |  | 10000000  10000000  10000000  10000000  10000000 | | N/A | 10000000  10000000  10000000  10000000  10000000 | N/A | |
| CSI Subframe Sets (Note 8) | CCSI,0 |  | 10000000  10000000  10000000  10000000  10000000 | | N/A | 10000000  10000000  10000000  10000000  10000000 | N/A | |
| CCSI,1 | 01111111  01111111  01111111  01111111  01111111 | | 01111111  01111111  01111111  01111111  01111111 |
| Number of control OFDM Symbols | |  | 3 | | 3 | 3 | 3 | |
| Maximum number of HARQ transmissions | |  | 1 | | | 1 | | |
| Reporting mode | |  | PUCCH 1-0 | | | PUCCH 1-0 | | |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | | PUCCH Format 2 | | |
| PUCCH Report Type for CQI | |  | 4 | | | 4 | | |
| Physical channel for RI reporting | |  | PUCCH Format 2 | | | PUCCH Format 2 | | |
| PUCCH Report Type for RI | |  | 3 | | | 3 | | |
| Reporting periodicity | | ms | *N*pd= 10 | | | *N*pd= 10 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 11 | | | 11 | | |
| *ri-ConfigurationInd* | |  | 5 | | | 5 | | |
| *cqi-pmi-ConfigurationIndex2* | |  | 10 | | | 10 | | |
| *ri-ConfigurationInd2* | |  | 2 | | | 2 | | |
| Cyclic prefix | |  | Normal | Normal | | Normal | | Normal |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.2 FDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.  Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5. | | | | | | | | |

Table 9.5.3.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| **1 | 0.9 | 1.05 |
| UE Category | 2-8 | 2-8 |

#### 9.5.3.2 TDD

The minimum performance requirement in Table 9.5.3.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ γ1.

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

Table 9.5.3.2-1 RI Test (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test1 | | | Test 2 | | | | |
| Cell 1 | Cell 2 | | Cell 1 | | Cell 2 | | |
| Bandwidth | | MHz | 10 | | | 10 | | | | |
| PDSCH transmission mode | |  | 3 | Note 11 | | 3 | | Note 11 | | |
| Uplink downlink configuration | |  | 1 | | | 1 | | | | |
| Special subframe configuration | |  | 4 | | | 4 | | | | |
| Downlink power allocation |  | dB | -3 | | | -3 | | | | |
|  | dB | -3 | | | -3 | | | |
| σ | dB | 0 | | | 0 | | | |
| Propagation condition and antenna configuration | |  | 2 x 2 EPA5 | | | 2 x 2 EPA5 | | | | |
| CodeBookSubsetRestriction bitmap | |  | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | N/A | | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | | N/A | | |
| Antenna correlation | |  | Low | | | Low | | | | |
| RI configuration | |  | Fixed RI=1 and follow RI | N/A | | Fixed RI=1 and follow RI | | N/A | | |
|  | | dB | 0 | -12 | | 20 | | 6 | | |
|  |  | dB[mW/15kHz | -98 (Note 4) | N/A | | -102 (Note 4) | | N/A | | |
|  | -98 (Note 5) | N/A | | -98 (Note 5) | | N/A | | |
|  | -98 (Note 6) | N/A | | -94.8 (Note 6) | | N/A | | |
|  | | dB[mW/15kHz] | -98 | -110 | | -78 | | -92 | | |
| Subframe Configuration | |  | Non-MBSFN | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | | |
| Cell Id | |  | 0 | 1 | | 0 | | 1 | | |
| Time Offset between Cells | | μs | 2.5 (synchronous cells) | | | 2.5 (synchronous cells) | | | | |
| ABS Pattern (Note 7) | |  | N/A | 0000000001  0000000001 | | N/A | | 0000000001  0000000001 | | |
| RLM/RRM Measurement Subframe Pattern (Note 8) | |  | 0000000001  0000000001 | N/A | | 0000000001  0000000001 | | N/A | | |
| CSI Subframe Sets  (Note 9) | CCSI,0 |  | 0000000001  0000000001 | N/A | | 0000000001  0000000001 | | N/A | | |
| CCSI,1 | 1100111000  1100111000 | 1100111000  1100111000 | |
| Number of control OFDM Symbols | |  | 3 | 3 | | 3 | | 3 | | |
| Maximum number of HARQ transmissions | |  | 1 | | | 1 | | | | |
| Reporting mode | |  | PUCCH 1-0 | | | PUCCH 1-0 | | | | |
| Physical channel for CCSI,0 CQI and RI reporting | |  | PUCCH Format 2 | | | PUCCH Format 2 | | | | |
| PUCCH Report Type for CQI | |  | 4 | | | 4 | | | | |
| Physical channel for CCSI,1 CQI and RI reporting | |  | PUSCH (Note 3) | | | PUSCH (Note 3) | | | | |
| PUCCH Report Type for RI | |  | 3 | | | 3 | | | | |
| Reporting periodicity | | ms | *N*pd= 10 | | | *N*pd= 10 | | | | |
| ACK/NACK feedback mode | |  | Multiplexing | | | Multiplexing | | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 8 | | | 8 | | | | |
| *ri-ConfigurationInd* | |  | 5 | | | 5 | | | | |
| *cqi-pmi-ConfigurationIndex2* | |  | 9 | | | 9 | | | | |
| *ri-ConfigurationInd2* | |  | 0 | | | 0 | | | | |
| Cyclic prefix | |  | Normal | | Normal | Normal | Normal | | | |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).  Note 2: Reference measurement channel RC.2 TDD in Cell 1 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  Note 3: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#3.  Note 4: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS  Note 5: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  Note 6: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  Note 7: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.  Note 8: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  Note 9: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  Note 10: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.  Note 11: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5. | | | | | | | | |

Table 9.5.3.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| **1 | 0.9 | 1.05 |
| UE Category | 2-8 | 2-8 |

## 9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

### 9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

#### 9.6.1.1 FDD

The following requirements apply to UE Category 3-8. For the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQIPcell – wideband CQIScell ≥ 2

for more than 90% of the time.

Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Pcell | Scell | |
| PDSCH transmission mode | |  | 1 | | |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | |
| SNR | | dB | 10 | 4 | |
|  | | dB[mW/15kHz] | -88 | -94 | |
|  | | dB[mW/15kHz] | -98 | -98 | |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 10 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 11 | | 16 [shift of 5 ms relative to Pcell] |
| Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. | | | | | |

Table 9.6.1.1-2: PUCCH 1-0 static test (FDD)

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 10MHz for both cells |
| 2 | 20MHz for both cells |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. | |

#### 9.6.1.2 TDD

The following requirements apply to UE Category 3-8. For the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQIPcell – wideband CQIScell ≥ 2

for more than 90% of the time.

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Pcell | Scell | |
| PDSCH transmission mode | |  | 1 | | |
| Uplink downlink configuration | |  | 2 | | |
| Special subframe configuration | |  | 4 | | |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | |
| SNR | | dB | 10 | 4 | |
|  | | dB[mW/15kHz] | -88 | -94 | |
|  | | dB[mW/15kHz] | -98 | -98 | |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 10 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 8 | | 13 [shift of 5 ms relative to Pcell] |
| Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. | | | | | |

Table 9.6.1.2-2: PUCCH 1-0 static test (TDD)

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 20MHz for both cells |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. | |

# 10 Performance requirement (MBMS)

## 10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.1-1: Common Test Parameters (FDD)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Number of HARQ processes | Processes | None |
| Subcarrier spacing | kHz | 15 kHz |
| Allocated subframes per Radio Frame (Note 1) |  | 6 subframes |
| Number of OFDM symbols for PDCCH |  | 2 |
| Cyclic Prefix |  | Extended |
| Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331. | | |

### 10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

Table 10.1.1-1: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-4 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Note 1: . | | | |

Table 10.1.1-2: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation  condition | Correlation Matrix and antenna | Reference value | | MBMS UE Category |
| BLER (%) | SNR(dB) |
| 1 | 10 MHz | R.37 FDD | OP.4 FDD | MBSFN channel model (Table B.2.6-1) | 1x2 low | 1 | 4.1 | 1-8 |
| 2 | 10 MHz | R.38 FDD | OP.4 FDD | 11.0 | 1-8 |
| 3 | 10 MHz | R.39 FDD | OP.4 FDD | 20.1 | 2-8 |
| 5.0MHz | R.39-1 FDD | OP.4 FDD | 20.5 | 1 |

## 10.2 TDD (Fixed Reference Channel)

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.2-1: Common Test Parameters (TDD)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Number of HARQ processes | Processes | None |
| Subcarrier spacing | kHz | 15 kHz |
| Allocated subframes per Radio Frame (Note 1) |  | 5 subframes |
| Number of OFDM symbols for PDCCH |  | 2 |
| Cyclic Prefix |  | Extended |
| Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS. | | |

### 10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

Table 10.2.1-1: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1-4 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Note 1: . | | | |

Table 10.2.1-2: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation  condition | Correlation Matrix and antenna | Reference value | | MBMS UE Category |
| BLER (%) | SNR(dB) |
| 1 | 10 MHz | R.37 TDD | OP.4 TDD | MBSFN channel model (Table B.2.6-1) | 1x2 low | 1 | 3.4 | 1-8 |
| 2 | 10 MHz | R.38 TDD | OP.4 TDD | 11.1 | 1-8 |
| 3a | 10 MHz | R.39 TDD | OP.4 TDD | 20.1 | 2-8 |
| 3b | 5MHz | R.39-1 TDD | OP.4 TDD | 20.5 | 1 |
| 4 | 1.4 MHz | R.40 TDD | OP.4 TDD | 5.8 | 1-8 |