# 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 Receiver antenna capability

The performance requirements are based on UE(s) that utilize one or more antenna receivers.

For all test cases, the SNR is defined as



where *NRX* denotes the number of receiver antenna connectors and the superscript receiver antenna connector *j*. 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.

For enhanced performance requirements type A, the SINR is defined as



where *NRX* denotes the number of reciver antenna connectors and the superscript receiver antenna connector *j*. The above SINR definition assumes that the REs are not precoded. The SINR 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 SINR requirement applies for the UE categories given for each test.

For the performance requirements specified in this clause, it is assumed that *NRX*=2 unless otherwise stated.

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.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

#### 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. The definition with respect to CA capabilities for 3CCs is given in Table 8.1.2.2-3.

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 (two bands) |
| CA2\_N2 | Intra-band non-contiguous CA (with two sub-blocks) |
| 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.  CA2\_N2 corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-3 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 | Bandwidth combination for TDD-FDD CA |
| CA2\_C | 5+5MHz, 5+10MHz, 10+10MHz, 20+20MHz | 20+20MHz, 15+20MHz | NA |
| CA2\_A2 | 10+10MHz, 10+15MHz, 10+20MHz, 15+20MHz, 20+20MHz | 20+20MHz | 10(FDD)+20(TDD)MHz, 15(FDD)+20(TDD)MHz, 20(FDD)+20(TDD)MHz |
| CA2\_N2 | 5+10MHz, 10+10MHz, 20+20MHz | 20+20MHz | 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. | | | |

Table 8.1.2.2-3: Definition of CA capability with 3 DL CCs

|  |  |
| --- | --- |
| CA Capability | CA Capability Description |
| CA3\_C | Intra-band contiguous CA |
| CA3\_A2 | Inter-band CA (two bands) |
| CA3\_A3 | Inter-band CA (three bands) |
| CA3\_N2 | Intra-band non-contiguous CA (with two sub-blocks) |
| Note 1: CA3\_C corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-1 for 3 DL CCs.  CA3\_A2 corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-2 for 3 DL CCs.  CA3\_A3 corresponds to E-UTRA CA configurations and bandwidth combination sets defined in and Table 5.6A.1-2a for 3 DL CCs.  CA3\_N2 corresponds to E-UTRA CA configurations and bandwidth combination sets defined in Table 5.6A.1-3 for 3 DL CCs. | |

The supported testable largest aggregated CA bandwidth combinations for 3CCs for each CA capability are listed in Table 8.1.2.2-4.

Table 8.1.2.2-4: Supported largest aggregated CA bandwidth combinations for different CA capability with 3 CCs

|  |  |  |  |
| --- | --- | --- | --- |
| CA capability | Bandwidth combination for FDD CA | Bandwidth combination for TDD CA | Bandwidth combination for TDD-FDD CA |
| CA3\_C | NA | 20+20+20MHz | NA |
| CA3\_A2 | 5+10+20MHz,  10+10+20MHz,  10+20+20MHz, 20+20+20MHz | 15+20+20MHz,  20+20+20MHz | 15(FDD)+20(TDD)+20(TDD)MHz, 20(FDD)+20(TDD)+20(TDD)MHz |
| CA3\_A3 | 10+10+20MHz, 10+15+15MHz, 10+15+20MHz, 10+20+20MHz, 15+15+20MHz, 15+20+20MHz, 20+20+20MHz | NA | NA |
| CA3\_N2 | NA | 20+20+20MHz | 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, unless otherwise stated.

#### 8.1.2.2A Definition of dual connectivity capability

The definition with respect to dual connectivity capabilities for configurations with 2CCs is given as in Table 8.1.2.2A-1.

Table 8.1.2.2A-1: Definition of dual connectivity capability with 2DL CCs

|  |  |
| --- | --- |
| Dual connectivity Capability | Dual connectivity capability Description |
| DC\_A\_2 | Inter-band dual connecitivty (two bands) |
| Note 1: DC\_A\_2 corresponds to E-UTRA dual connectivity configurations and bandwidth combination sets defined for inter-band dual connecitivty (two bands) as specified in 5.6C. | |

The supported testable dual connectivity bandwidth combinations for 2CCs for each dual connectivity capability are listed in Table 8.1.2.2A-2.

Table 8.1.2.2A-2: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 2DL CCs

|  |  |  |
| --- | --- | --- |
| Dual connectivity capability | Bandwidth combination for FDD dual connectivity | Bandwidth combination for TDD dual connectivity |
| DC\_A\_2 | 10+10MHz, 10+20MHz, 15+15MHz, 15+20MHz, 20+20MHz | 20+20MHz |
| Note 1: This table is only for information and applicability and test rules of dual connectivity performance requirements are specified in 8.1.2.3A | | |

#### 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 and 3DL CCs in Table 8.2.2.3-2. 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+20 MHz, 5+5 MHz, and 10MHz+5MHz. |
| 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, 5+5 MHz, and 10MHz+5MHz. |
| 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 |
| CA tests with 2CCs in Clause 8.2.1.8.1 | CA\_N | CA\_3A-3A defined in Table 5.6A.1-3 | 10+10 MHz |
| CA tests with 2CCs in Clause 8.2.2.8.1 | CA2\_C | CA\_41C defined in Table 5.6A.1-1 | 20+20 MHz |
| 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

Table 8.1.2.3-2: Applicability and test rules for CA UE demodulation tests with 3 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 3CCs in Clause 8.2.1.1.1, 8.2.1.4.3, 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 3CCs in Clause 8.2.1.3.1 | Each supported CA capability | Any one of the supported FDD CA configurations in each CA capability with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 3CCs in Clause 8.2.2.1.1, 8.2.2.4.3, 8.7.2 | 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 3CCs 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 3CCs in Clause 8.2.2.8.1 | CA3\_C | CA\_41D defined in Table 5.6A.1-1 | 20+20+20 MHz |
| 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

#### 8.1.2.3A Applicability and test rules for different dual connectivity configuration and bandwidth combination set

The performance requirement for dual connectivity UE demodulation tests in Clause 8 are defined independent of dual connectivity configurations and bandwidth combination sets specified in Clause 5.6C.1. For UEs supporting difrerent dual connectivity configurations and bandwidth combination stes, the applicability and test rules are defined for the tests for the configurations with 2CCs in Table 8.1.2.3A-1. For simplicity, dual connectivity configurationbelow refers to combination of dual connectivity configuration and bandwidth set.

Both CA performance requirements and dual connectivity performance requirements are applied for dual connectivity capable UE.

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Tests** | **Dual connectivity capability where the tests apply** | **Dual connectivity configuration from the selected CA capbility where the tests apply** | **Dual connectivity Bandwidth combination to be tested in priority order** |
| Dual connectivity test in Clause 8.2.1.4.3A, 8.7.6 | Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination | Any one of the supported FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combimation | Largest dual connectivity aggregated bandwidth combination |
| Dual connectivity test in Clause 8.2.2.4.3A, 8.7.7 | Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination | Any one of the supported TDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combination | Largest dual connectivity aggregated 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 DC or CA configuration is 1. | | | |

#### 8.1.2.3B Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD 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 TDD-FDD CA in Table 8.1.2.3B-1 and in Table 8.1.2.3B-2 for 3 DL TDD-FDD CA. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3B-1: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA 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 8.2.3.1.1,  8.2.3.2.1A,  8.2.3.3.1,  8.7.5.1 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.3.2.1 | Each supported CA capability | Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.3.1.2,  8.2.3.2.2A,  8.2.3.3.2,  8.7.5.2 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 8.2.3.2.2 | Each supported CA capability | Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

Table 8.1.2.3B-2: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA with 3 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 3CCs in Clause 8.2.3.1.1,  8.2.3.2.1A,  8.2.3.3.1, 8.7.5.1 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 3CCs in Clause 8.2.3.2.1 | Each supported CA capability | Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 3CCs in Clause 8.2.3.1.2,  8.2.3.2.2A,  8.2.3.3.2, 8.7.5.2 | Any one of the supported CA capabilities with largest aggregated CA bandwidth combination | Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 3CCs in Clause 8.2.3.2.2 | Each supported CA capability | Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

#### 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.

For TDD FDD tests specified in 8.2.3.1, 8.2.3.2, 8.2.3.3, and 8.7.5, if corresponding TDD FDD CA tests are tested, the test coverage can be considered fulfilled without executing both FDD and TDD single carrier tests.

For FDD CA tests specified in 8.2.1.1.1, 8.2.1.4.3, and 8.7.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For FDD CA tests specified in 8.2.1.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.1.1, 8.2.2.4.3, and 8.7.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.1, 8.2.3.3, and 8.7.5, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.2, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For FDD CA power imbalance tests specified in 8.2.1.7.1, if they are are tested with FDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with FDD intra-band contiguous CA configurations with 3 DL CCs supported by the UE.

For TDD CA power imbalance tests specified in 8.2.2.7.1, if they are are tested with TDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with TDD intra-band contiguous CA configurations with 3 DL CCs supported by the UE.

#### 8.1.2.5 Applicability of performance requirements for Type B receiver

For TM10 capable UE, if corresponding tests specified in 8.3.1.1F, 8.3.2.1G, 9.3.8.3 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.3.1.1C, 8.3.2.1D, 9.3.8.2. For a UE which does not have TM10 capability, the tests specified in sections 8.3.1.1C, 8.3.2.1D, 9.3.8.2 should be used.

### 8.1.3 UE category and UE DL category

UE category and UE DL category refer to *ue-Category* and *ue-CategoryDL* define in 4.1 and 4.1A from [12]. A UE that belongs to either a UE category or a UE DL category indicated in UE performance requirements in subclause 8, 9, 10 shall fulfil the corresponding requirements.

A UE indicating DL category 13 may indicate category 9 or 10 and shall thereby fulfil all requirements in subclause 8, 9, 10 that are indicated for either cat 9 or DL Cat 13 UEs. For SDR tests in section 8.7 both cat 9 and cat 13 test shall be used for this UE while for the other test only Cat 13 tests needs to be done.

## 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 and 256QAM | |
| 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 unless otherwise stated | |
| 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 with 2 DL CCs, 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.

For CA with 3 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-6, based on single carrier requirement speicified in Table 8.2.1.1.1-5, 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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 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 | 10 MHz | R.2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 | ≥1 |
| 2 | 10 MHz | R.2 FDD | OP.1 FDD | ETU70 | 1x2 Low | 70 | -0.4 | ≥1 |
| 3 | 10 MHz | R.2 FDD | OP.1 FDD | ETU300 | 1x2 Low | 70 | 0.0 | ≥1 |
| 4 | 10 MHz | R.2 FDD | OP.1 FDD | HST | 1x2 | 70 | -2.4 | ≥1 |
| 5 | 1.4 MHz | R.4 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 0.0 | ≥1 |
| 6 | 10 MHz | R.3 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 6.7 | ≥2 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 6.7 | 1 |
| 5 MHz  (Note 4) | R.3-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 6.7 | ≥2 |
| 7 | 10 MHz | R.3 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.4 | ≥2 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.4 | 1 |
| 5 MHz  (Note 4) | R.3-1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.4 | ≥2 |
| 8 | 10 MHz | R.3 FDD | OP.1 FDD | ETU300 | 1x2 High | 70 | 9.4 | ≥2 |
| 5 MHz | R.3-1 FDD | OP.1 FDD | ETU300 | 1x2 High | 70 | 9.4 | 1 |
| 5 MHz  (Note 4) | R.3-1 FDD | OP.1 FDD | ETU300 | 1x2 High | 70 | 9.4 | ≥2 |
| 9 | 3 MHz | R.5 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.6 | ≥1 |
| 10 | 5 MHz | R.6 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | 17.4 | ≥2 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 17 | 10 MHz | R.1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.9 | ≥1 |
| 18 | 20 MHz | R.1 FDD | OP.1 FDD | ETU70 | 1x2 Low | 30 | 1.9 | ≥1 |
| 19 | 10 MHz | R.41 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -5.4 | ≥1 |
| Note 1: Void.  Note 2: Void.  Note 3: Void.  Note 4: Test case applicability is defined in 8.1.2.1. | | | | | | | | |

Table 8.2.1.1.1-3: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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 for Tests in Table 8.2.1.1.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.1.1-6.  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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 (Note 2) |
| 2 | 2x20 MHz | R.42 FDD | OP.1 FDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.3 | ≥5 |
| 3 | 2x5 MHz | R.42-2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 | ≥2 |
| OP.1 FDD | 70 | -1.0 |
| 4 | 10MHz+5MHz | R.2 FDD for 10MHz CC | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 | ≥3 |
| R.42-2 FDD for 5MHz CC | OP.1 FDD | 70 | -1.0 |
| 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. | | | | | | | | |

Table 8.2.1.1.1-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propagation condition | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.4 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.3 |
| 3MHz | R.42-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.1 |
| 5MHz | R.42-2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 |
| 10MHz | R.2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |
| 15MHz | R.42-3 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.6 |
| 20MHz | R.42 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |

Table 8.2.1.1.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 3x20MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 3 | 20MHz+20MHz+10MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 4 | 20MHz+15MHz+15MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 5 | 20MHz+15MHz+10MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 6 | 20MHz+10MHz+10MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 7 | 15MHz+15MHz+10MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| 8 | 20MHz+10MHz+5MHz | As specified in Table 8.2.1.1.1-5 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3  Note 2: 30usec timing difference between PCell and any SCell which is not within the same band or sub-block as PCell, is applied in inter-band CA case, where PCell can be assigned on any CC. | | | |

##### 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 |

#### 8.2.1.2 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 |
| 5 MHz | R.11-2 FDD | OP.1 FDD | EVA5 | 2x2 Medium | 70 | 5.9 | 1 |
| 5 MHz  (Note 1) | R.11-2 FDD | OP.1 FDD | EVA5 | 2x2 Medium | 70 | 5.9 | ≥2 |
| 2 | 10 MHz | R.10 FDD | OP.1 FDD | HST | 2x2 | 70 | -2.3 | ≥1 |
| Note 1: Test case applicability is defined in 8.1.2.1. | | | | | | | | |

##### 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 |
| 2 | 10 MHz | R.13 FDD | OP.1 FDD | ETU70 | 4x2 Low | 70 | -0.9 | ≥1 |

##### 8.2.1.2.3 Minimum Requirement 2 Tx Antenna Port (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 |
| 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. | | | | | | | | | |

##### 8.2.1.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.2.3A-2, with the addition of parameters in Table 8.2.1.2.3A-1. 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 cells with CRS assistance information. In Table 8.2.1.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table8.2.1.2.3A-2 | | 12 | | 10 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 5) | | |  | | N/A | | 11000000  11000000  11000000  11000000  11000000 | | 11000000  11000000  11000000  11000000  11000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 11000000 11000000 11000000 11000000 11000000 | | N/A | | N/A | |
| CCSI,1 |  | | 00111111 00111111 00111111 00111111 00111111 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| PDSCH transmission mode | | |  | | 2 | | Note 9 | | Note 9 | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test. | | | | | | | | | | |

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

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note1) | | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) Note 5 | SNR (dB) (Note 3) |
| 1 | R.11-4 FDD Note 4 | OP.1FDD | OP.1FDD | OP.1FDD | EVA5 | EVA5 | EVA5 | 2x2 Medium | 70 | 3.4 | ≥2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to  of cell 1.  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. | | | | | | | | | | | |

##### 8.2.1.2.4 Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.1.2.4-2, with the addition of parameters in Table 8.2.1.2.4-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.1.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 | | -3 | |
| σ | dB | | 0 | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | | N/A | |
| DIP (Note 2) | | | dB | | N/A | | -2.23 | | -8.06 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Cyclic Prefix | | |  | | Normal | | Normal | | Normal | |
| Cell Id | | |  | | 0 | | 1 | | 2 | |
| Number of control OFDM symbols | | |  | | 2 | | 2 | | 2 | |
| PDSCH transmission mode | | |  | | 2 | | N/A | | N/A | |
| Interference model | | |  | | N/A | | As specified in clause B.5.2 | | As specified in clause B.5.2 | |
| Probability of occurrence of transmission rank in interfering cells | | Rank 1 | % | | N/A | | 80 | | 80 | |
| Rank 2 | % | | N/A | | 20 | | 20 | |
| Reporting interval | | | ms | | 5 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-0 | | N/A | | N/A | |
| Physical channel for CQI reporting | | |  | | PUSCH(Note 5) | | N/A | | N/A | |
| cqi-pmi-ConfigurationIndex | | |  | | 2 | | N/A | | N/A | |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms and Cell 3 transmission is delayed with respect to Cell 1 by 0.67 ms.  Note 5: 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 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0. | | | | | | | | | | |

Table 8.2.1.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (Note 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SINR (dB) (Note 2) |
| 1 | R.46 FDD | OP.1 FDD | N/A | N/A | EVA70 | EVA70 | EVA70 | 2x2 Low | 70 | -1.1 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.1.2.5 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.1.2.5-2, with the addition of parameters in Table 8.2.1.2.5-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.1.2.5-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.5-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | |  | dB | -3 | -3 | -3 |
|  | dB | -3 (NOTE 1) | -3 | -3 |
| σ | dB | 0 | 0 | 0 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 6 | 1 |
| Number of control OFDM symbols | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH | | |  | 3 | 3 | 3 |
| PDSCH transmission mode | | |  | 2 | 2 | 2 |
| Interference model | | |  | N/A | As specified in clause B.6.1 | As specified in clause B.6.1 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.2.1.2.5-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-10  FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 15.5 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.1.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.1.2.6-2, with the addition of parameters in Table 8.2.1.2.6-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.1.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | | dB | | -3 | | 0 | | 0 | |
|  | | dB | | -3 (NOTE 1) | | 0 | | 0 | |
| σ | | dB | | 0 | | -3 | | -3 | |
| Cell-specific reference signals | | | |  | | Antenna ports 0,1 | | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | | dBm/15kHz | | -98 | | | | | |
|  | | | | dB | | N/A | | 3.28 | | 0.74 | |
| BWChannel | | | | MHz | | 10 | | 10 | | 10 | |
| Cyclic Prefix | | | |  | | Normal | | Normal | | Normal | |
| Cell Id | | | |  | | 0 | | 1 | | 6 | |
| Number of control OFDM symbols | | | |  | | 3 | | 3 | | 3 | |
| CFI indicated in PCFICH | | | |  | | 3 | | Random from set {1,2,3} | | Random from set {1,2,3} | |
| PDSCH transmission mode | | | |  | | 2 | | 9 | | 9 | |
| Interference model | | | |  | | N/A | | As specified in clause B.6.4 | | As specified in clause B.6.4 | |
| CSI reference signals | | | |  | | N/A | | Antenna ports 15,16 | | Antenna ports 15,16 | |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | | Subframes | | N/A | | 10 / 1 | | 10 / 1 | |
| CSI reference signal configuration | | | |  | | N/A | | 6 | | 7 | |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | | Subframes / bitmap | | N/A | | 6 /  0100000000000000 | | 6 /  0010000000000000 | |
| Time offset to cell 1 | | | | us | | N/A | | 5 | | -5 | |
| Frequency offset to cell 1 | | | | Hz | | N/A | | 600 | | -600 | |
| MBSFN | | | |  | | Not configured | | Not configured | | Not configured | |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | | |  | | N/A | | {dB-6, dB-3, dB0} | | {dB-6, dB-3, dB0} | |
| transmissionModeList-r12 | | |  | | N/A | | {2,3,4,8,9} | | {2,3,4,8,9} | |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | | | | | | |

Table 8.2.1.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-9  FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 8.4 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 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.

For CA with 2 DL CC, 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.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.3.1-6, based on single carrier requirement specified in Table 8.2.1.3.1-5, 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 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 1-4 |
| 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 | Bandwidth | Reference channel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE category |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 13.0 | ≥2 |
| 2  (Note 3) | 5 MHz | R.11-2 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.7 | ≥2 |
| 3 | 10 MHz | R.35 FDD | OP.1 FDD | EVA200 | 2x2 Low | 70 | 20.2 | ≥2 |
| 4 | 10 MHz | R.35-4 FDD | OP.1 FDD | ETU600 | 2x2 Low | 70 | 20.8 | ≥2 |
| 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.  Note 3: Test case applicability is defined in 8.1.2.1. | | | | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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 for Tests in Table 8.2.1.3.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-6.  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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num** | **Bandwidth** | **Reference channel** | **OCNG pattern** | **Propa-**  **gation condi-tion** | **Correlation matrix and antenna config.** | **Reference value** | | **UE category** |
| **Fraction of maximum**  **Throughput (%)** | **SNR (dB)** |
| 1  (Note 2) | 2x10 MHz | R.11 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.7 | ≥3 |
| 2  (Note 2) | 2x20 MHz | R.30 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | ≥5 |
| 3 | 2x5 MHz | R.11-2 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.7 | ≥2 |
| 4 | 10MHz+5MHz | R.11 FDD for 10MHz CC, | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.0 | ≥3 |
| R.11-2 FDD for 5MHz CC | OP.1 FDD (Note 1) | 70 | 12.7 |
| 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. | | | | | | | | |

Table 8.2.1.3.1-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condition | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.11-5 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 13.6 |
| 3MHz | R.11-6 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 5MHz | R.11-2 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 10 MHz | R.11 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 15MHz | R.11-7 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 20MHz | R.30 FDD | OP. 1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |

Table 8.2.1.3.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 3x20MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 3 | 20MHz+20MHz+10MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 4 | 20MHz+15MHz+15MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 5 | 20MHz+15MHz+10MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 6 | 20MHz+10MHz+10MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 7 | 15MHz+15MHz+10MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| 8 | 20MHz+10MHz+5MHz | As specified in Table 8.2.1.3.1-5 per CC | ≥5 |
| Note 1: 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. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.2.1.3.1A-3.

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1-7** |
| 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 soft buffer management test (FRC) for CA

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Bandwidth | Reference channel | OCNG pattern | Propa-  gation condition | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 2x20 MHz | R.30 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 |
| 2 | 15MHz +  10MHz | R.35-2 FDD for 15MHz CC | OP.1 FDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.1 |
| R.35-3 FDD for 10MHz CC | OP.1 FDD (Note 1) | 70 | 15.1 |
| 3 | 20MHz + 10MHz | R.30 FDD for 20MHz CC | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.5 |
| R.11 FDD for 10MHz CC | OP.1 FDD (Note 1) | 70 | 13.5 |
| 4 | 20MHz + 15MHz | R.30 FDD for 20MHz CC | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.5 |
| R.30-1 FDD for 15MHz CC | OP.1 FDD (Note 1) | 70 | 13.5 |
| 5 | 2x20 MHz | R.35-1 FDD | OP.1 FDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.8 |
| 6 | 20MHz + 10MHz | R.35-1 FDD for 20MHz CC | OP.1 FDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.9 |
| R.35-3 FDD for 10MHz CC | OP.1 FDD (Note 1) | 70 | 15.9 |
| 7 | 20MHz + 15MHz | R.35-1 FDD for 20MHz CC | OP.1 FDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.9 |
| R.35-2 FDD for 15MHz CC | OP.1 FDD (Note 1) | 70 | 15.9 |
| Note 1: For CA test cases, the OCNG pattern applies for each CC.  Note 2: For Test 2, 3, 4, 6, 7 the Fraction of maximum Throughput applies to each CC.  Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | |

Table 8.2.1.3.1A-3: Test points for soft buffer management tests for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE category** | **Bandwidth combination with maximum aggregated bandwidth (Note 1)** | | | |
| **2x20MHz** | **15MHz+10MHz** | **20MHz+10MHz** | **20MHz+15MHz** |
| 3 | 1 | 2 | 3 | 4 |
| 4 | 5 | N/A | 6 | 7 |
| Note 1: Maximum over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1-1and Table 5.6A.1-2. | | | | |

##### 8.2.1.3.1B Enhanced Performance Requirement Type C –2Tx Antenna Ports

The requirements are specified in Table 8.2.1.3.1B-2, with the addition of the parameters in Table 8.2.1.3.1B-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.

Table 8.2.1.3.1B-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: . | | | |

Table 8.2.1.3.1B-2: Enhanced Performance Requirement Type C for Large Delay CDD (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Bandwidth | Reference channel | OCNG pattern | Propa-  gation condi-tion | Correlation matrix and antenna config. | Reference value | | UE category |
| Fraction of maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.11 FDD | OP.1 FDD | EVA70 | 2x2 Medium | 70 | 17.8 | ≥2 |

##### 8.2.1.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.1.3.1C-2, with the addition of parameters in Table 8.2.1.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.1.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.1.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | |
| Bandwidth | | | MHz | | 10 MHz | | | |
| Downlink power allocation |  | | dB | | -3 | | 0 | |
|  | | -3 (Note 1) | | 0 | |
| σ | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna port 0 | |
| Cyclic Prefix | | |  | | Normal | | Normal | |
| Cell ID | | |  | | 0 | | 1 | |
| Transmission mode | | |  | | 3 | | Note 2 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | |
| (Note 3) | | | dB | | Reference Value in Table 8.2.1.3.1C-2 | | 12.95 | |
| Correlation and antenna configuration | | |  | | Medium (2x2) | | Medium(1x2) | |
| Number of OFDM symbols for PDCCH | | |  | | 2 | | N/A | |
| Max number of HARQ transmissions | | |  | | 4 | | N/A | |
| Redundancy version coding sequence | | |  | | {0,1,2,3} | | N/A | |
| Note 1:  Note 2: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.2 applying OCNG pattern OP.5 FDD as defined in Annex A.5.1.5.  Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.  Note 4: All cells are time-synchronous.  Note 5: SIB-1 will not be transmitted in Cell2 in this test. | | | | | | | | |

Table 8.2.1.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Reference Value | | UE Category |
|  | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 2) |  |
| 1 | R.11-8 FDD | OP.1 FDD | OP.5 FDD | EVA70 | EVA70 | 70 | 19.9 | ≥2 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to  of Cell 1. | | | | | | | | |

##### 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 |

##### 8.2.1.3.3 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 |
| 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 2) | | 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 |
| 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. | | | | | | | | | |

##### 8.2.1.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.4-2, with the addition of parameters in Table 8.2.1.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 ad Cell3.

Table 8.2.1.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.1.3.4-2 | | Reference Value in Table 8.2.1.3.4-2 | | Reference Value in Table 8.2.1.3.4-2 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 1 | | 126 | |
| ABS pattern (Note 5) | | |  | | N/A | | 11000000  11000000  11000000  11000000  11000000 | | 11000000  11000000  11000000  11000000  11000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 11000000 11000000 11000000 11000000 11000000 | | N/A | | N/A | |
| CCSI,1 |  | | 00111111 00111111 00111111 00111111 00111111 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| PDSCH transmission mode | | |  | | 3 | | Note 9 | | Note 9 | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test. | | | | | | | | | | |

Table 8.2.1.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Number** | | **Reference Channel** | |  | | | | **OCNG Pattern** | | | | | | **Propagation Conditions (Note1)** | | | | | | **Correlation Matrix and Antenna Configuration (Note 2)** | | **Reference Value** | | | | UE Category | |
| **Cell 2** | | **Cell 3** | | **Cell 1** | | **Cell 2** | | **Cell 3** | | **Cell 1** | | **Cell 2** | | **Cell 3** | | Fraction of Maximum Throughput (%) Note 5 | | **SNR (dB) (Note 3)** | |
| 1 | R.11 FDD Note 4 | | 9 | | 7 | | OP.1FDD | | OP.1FDD | | OP.1FDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 70 | | 13.9 | | ≥2 | |
| 2 | R.35 FDD Note 4 | | 9 | | 1 | | OP.1FDD | | OP.1FDD | | OP.1FDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 70 | | 22.6 | | ≥2 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1.  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. | | | | | | | | | | | | | | | | | | | | | | | | | | |

#### 8.2.1.4 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 1A | | Test 2 | |
| Downlink power allocation |  | | dB | | -3 | | -3 | | -3 | |
|  | | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | | dB | | 0 | | 0 | | 0 | |
| at antenna port | | | dBm/15kHz | | -98 | | -98 | | -98 | |
| Precoding granularity | | | PRB | | 6 | | 4 | | 50 | |
| PMI delay (Note 2) | | | ms | | 8 | | 8 | | 8 | |
| Reporting interval | | | ms | | 1 | | 1 | | 1 | |
| Reporting mode | | |  | | PUSCH 1-2 | | PUSCH 1-2 | | PUSCH 3-1 | |
| CodeBookSubsetRestriction bitmap | | |  | | 001111 | | 001111 | | 001111 | |
| PDSCH transmission mode | | |  | | 4 | | 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 |
| 1A (Note 1) | 5 MHz | R.10-2 FDD | OP.1 FDD | EVA5 | 2x2 Low | 70 | -2.9 | ≥1 |
| 2 | 10 MHz | R.10 FDD | OP.1 FDD | EPA5 | 2x2 High | 70 | -2.3 | ≥1 |
| Note 1: Test case applicability is defined in 8.1.2.1. | | | | | | | | |

##### 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 |

##### 8.2.1.4.1B Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1B-2, with the addition of the parameters in Table 8.2.1.4.1B-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 precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.1.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 | | -3 | |
| σ | dB | | 0 | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | | N/A | |
| DIP (Note 2) | | | dB | | N/A | | -1.73 | | -8.66 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Cyclic Prefix | | |  | | Normal | | Normal | | Normal | |
| Cell Id | | |  | | 0 | | 1 | | 2 | |
| Number of control OFDM symbols | | |  | | 2 | | 2 | | 2 | |
| PDSCH transmission mode | | |  | | 6 | | N/A | | N/A | |
| Interference model | | |  | | N/A | | As specified in clause B.5.3 | | As specified in clause B.5.3 | |
| Probability of occurrence of transmission rank in interfering cells | | Rank 1 | % | | N/A | | 80 | | 80 | |
| Rank 2 | % | | N/A | | 20 | | 20 | |
| Precoding granularity | | | PRB | | 50 | | 6 | | 6 | |
| PMI delay (Note 4) | | | ms | | 8 | | N/A | | N/A | |
| Reporting interval | | | ms | | 5 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-1 | | N/A | | N/A | |
| CodeBookSubsetRestriction bitmap | | |  | | 1111 | | N/A | | N/A | |
| Physical channel for CQI reporting | | |  | | PUSCH(Note 6) | | N/A | | N/A | |
| cqi-pmi-ConfigurationIndex | | |  | | 2 | | N/A | | N/A | |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 4: 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 5: All cells are time-synchronous.  Note 6: 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 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0. | | | | | | | | | | |

**Table 8.2.1.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (Note 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SINR (dB) (Note 2) |
| 1 | R.47 FDD | OP.1 FDD | N/A | N/A | EVA5 | EVA5 | EVA5 | 2x2 Low | 70 | 0.8 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.1.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.4.1C-2, with the addition of parameters in Table 8.2.1.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.1.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.1.4.1C-2 | | 12 | | 10 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 5) | | |  | | N/A | | 11000000  11000000  11000000  11000000  11000000 | | 11000000  11000000  11000000  11000000  11000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 11000000 11000000 11000000 11000000 11000000 | | N/A | | N/A | |
| CCSI,1 |  | | 00111111 00111111 00111111 00111111 00111111 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| PDSCH transmission mode | | |  | | 6 | | Note 9 | | Note 9 | |
| Precoding granularity | | | PRB | | 50 | | N/A | | N/A | |
| PMI delay (Note 10) | | | ms | | 8 | | N/A | | N/A | |
| Reporting interval | | | ms | | 1 | | N/A | | N/A | |
| Peporting mode | | |  | | PUSCH 3-1 | | N/A | | N/A | |
| CodeBookSubsetRestriction bitmap | | |  | | 1111 | | N/A | | N/A | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: 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 11: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 12: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test. | | | | | | | | | | |

Table 8.2.1.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)– Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note1) | | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) Note 5 | SNR (dB) (Note 3) |
| 1 | R.11 FDD Note 4 | OP.1FDD | OP.1FDD | OP.1FDD | EPA5 | EPA5 | EPA5 | 2x2 High | 70 | 6.1 | ≥2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1.  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. | | | | | | | | | | | |

##### 8.2.1.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1D-2, with the addition of the parameters in Table 8.2.1.4.1D-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 precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.1.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | -3 | -3 | | -3 | |
|  | dB | -3 (NOTE 1) | -3 | | -3 | |
| σ | dB | 0 | 0 | | 0 | |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | -98 | | | | |
| Test number (NOTE 4) | | |  |  | Test 1 | Test 2 | Test 1 | Test 2 |
|  | | | dB | N/A | 13.91 | 3.28 | 3.34 | 0.74 |
| Cell Id | | |  |  | 6 | 1 | 1 | 6 |
| CFI indicated in PCFICH | | |  |  | 3 | Random from set {1,2,3} | 3 | Random from set {1,2,3} |
| BWChannel | | | MHz | 10 | 10 | | 10 | |
| Cyclic Prefix | | |  | Normal | Normal | | Normal | |
| Number of control OFDM symbols | | |  | 3 | 3 | | 3 | |
| PDSCH transmission mode | | |  | 4 | 4 | | 4 | |
| Interference model | | |  | N/A | As specified in clause B.6.3 | | As specified in clause B.6.3 | |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.3 | | As specified in clause B.6.3 | |
| Time offset to cell 1 | | | us | N/A | 2 | | 3 | |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | | 300 | |
| MBSFN | | |  | Not configured | Not configured | | Not configured | |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | | {dB-6, dB-3, dB0} | |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | | {2,3,4,8,9} | |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].  NOTE 4: Test 1 and Test 2 are defined in Table 8.2.1.4.1D-2. | | | | | | | | |

Table 8.2.1.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Num | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-10  FDD | OP.1 FDD | N/A | N/A | EVA5 | EVA5 | EVA5 | 2x2 Low | 85 | 17.0 | ≥1 |
| 2 | R.11-9  FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 10.1 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 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 | Test 2A | Test 3 |
| Downlink power allocation |  | dB | -3 | -3 | -3 |
|  | dB | -3 (Note 1) | -3 (Note 1) | -3 (Note 1) |
| σ | dB | 0 | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 |
| Precoding granularity | | PRB | 50 | 25 | 6 |
| PMI delay (Note 2) | | ms | 8 | 8 | 8 |
| Reporting interval | | ms | 1 | 1 | 1 |
| Reporting mode | |  | PUSCH 3-1 | PUSCH 3-1 | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 110000 | 110000 | 110000 |
| PDSCH transmission mode | |  | 4 | 4 | 4 |
| Number of OFDM symbols for PDCCH per component carrier | | OFDM symbol | 2 | 3 | 1 |
| 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 | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.35 FDD | OP.1 FDD | EPA5 | 2x2 Low | 70 | 18.9 | ≥2 | ≥6 |
| 2 | 10 MHz | R.11 FDD | OP.1 FDD | ETU70 | 2x2 Low | 70 | 14.3 | ≥2 | ≥6 |
| 2A  (Note 1) | 5 MHz | R.11-2 FDD | OP.1 FDD | ETU70 | 2x2 Low | 70 | 14.0 | ≥2 | ≥6 |
| 3 | 10MHz  256QAM | R. 65 FDD | OP.1 FDD | EVA5 | 2x2 Low | 70 | 25.3 | 11-12 | ≥11 |
| Note 1: Test case applicability is defined in 8.1.2.1. | | | | | | | | | |

##### 8.2.1.4.2A Enhanced Performance Requirement Type C – Multi-layer Spatial Multiplexing 2Tx Antenna Ports

The requirements are specified in Table 8.2.1.4.2A-2,with the addition of the parameters in Table 8.2.1.4.2A-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 precoding.

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| 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 8.2.1.4.2A-2: Enhanced Performance Requirement Type C for Multi-Layer Spatial Multiplexing with TM4 (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 | ETU70 | 2x2 Medium | 70 | 18.3 | ≥2 |

##### 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 with 2 DL CCs, the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-3 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.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.4.3-6, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 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 8.2.1.4.3-1: 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 |
| Note 1: Void. | | | | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs |
| PMI delay (Note 2) | | ms | 8 |
| Reporting interval | | ms | 1 |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 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 for Tests in Table 8.2.1.4.3-4, and with PUCCH format 3 for Tests in Table 8.2.1.4.3-6.  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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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.14 FDD | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | 10.8 | ≥3 |
| 2 | 2x20 MHz | R.14-3 FDD | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | 10.9 | ≥5 |
| 3 | 2x5 MHz | R.14-6 FDD | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | 9.5 | ≥2 |
| OP.1 FDD (Note 1) | 70 | 9.5 |
| 4 | 10MHz+5MHz | R.14 FDD for 10MHz CC | OP.1 FDD (Note 1) | EVA5 | 4x2 Low | 70 | 10.1 | ≥3 |
| R.14-6 FDD for 5MHz CC | OP.1 FDD (Note 1) | 70 | 9.5 |
| 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. | | | | | | | | |

Table 8.2.1.4.3-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.14-4 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.4 |
| 3MHz | R.14-5 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 5MHz | R.14-6 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 10 MHz | R.14 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 15MHz | R.14-7 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 20MHz | R.14-3 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.3 |

Table 8.2.1.4.3-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 3x20MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 3 | 20MHz+20MHz+10MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 4 | 20MHz+15MHz+15MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 5 | 20MHz+15MHz+10MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 6 | 20MHz+10MHz+10MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 7 | 15MHz+15MHz+10MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| 8 | 20MHz+10MHz+5MHz | As specified in Table 8.2.1.4.3-5 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3 | | | |

##### 8.2.1.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.1.4.3A-3, based on single carrier requirement specified in Table 8.2.1.4.3A-2, with the addition of the parameters in Table 8.2.1.4.3A-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 by using dual connectivity transmission.

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Values |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs |
| PMI delay (Note 2) | | ms | 8 |
| Reporting interval | | ms | 1 |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| PDSCH transmission mode | |  | 4 |
| ACK/NACK transmission | |  | Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG |
| CSI feedback | |  | Separate PUSCH feedbacks on the MCG and SCG |
| Time offset between MCG CC and SCG CC | | μs | 0 for UE under test supporting synchronous dual connectivity;  334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 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: The same PDSCH transmission mode is applied to each component carrier.  Note 4: As defined in TS36.300 [11].  Note 5: If the UE supports both SCG bearer and Split bearer, the SCG bearer is configured. | | | |

Table 8.2.1.4.3A-2: Single carrier performance for multiple dual connectivity configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.14-4 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 10.36 |
| 3MHz | R.14-5 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 5MHz | R.14-6 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 10 MHz | R.14 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 15MHz | R.14-7 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 20MHz | R.14-3 FDD | OP. 1 FDD | EVA5 | 4x2 Low | 70 | 10.3 |

Table 8.2.1.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | Band-width combination | Requirement | UE category |
| 1 | 2x20 MHz | As specified in Table 8.2.1.4.3A-2 per CC | ≥5 |
| 2 | 15+20 MHz | As specified in Table 8.2.1.4.3A-2 per CC | ≥5 |
| 3 | 10+20MHz | As specified in Table 8.2.1.4.3A-2 per CC | ≥5 |
| 4 | 2x15 MHz | As specified in Table 8.2.1.4.3A-2 per CC | ≥5 |
| 5 | 2x10 MHz | As specified in Table 8.2.1.4.3A-2 per CC | ≥3 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different dual connectvity configurations and bandwidth combination sets is defined in 8.1.2.3A. | | | |

#### 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

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

##### 8.2.1.7.1 Minimum Requirement

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 | Test 2-3 |
| Downlink power allocation |  | | dB | 0 | 0 |
|  | | dB | 0 (Note 1) | 0 (Note 1) |
| σ | | dB | 0 | 0 |
| at antenna port | | | dBm/15kHz | Off (Note 2) | Off (Note 2) |
| Symbols for unused PRBs | | |  | OCNG (Note 3) | OCNG (Note 3) |
| Modulation | | |  | 64 QAM | 64 QAM |
| Maximum number of HARQ transmission | | |  | 1 | 1 |
| Redundancy version coding sequence | | |  | {0} | {0} |
| PDSCH transmission mode of PCell | | |  | 1 | 3 |
| PDSCH tramsmission mode of SCell | | |  | 3 | 1 |
| OCNG Pattern | | PCell |  | OP.1 FDD | OP.5 FDD |
| SCell |  | OP.5 FDD | OP.1 FDD |
| Propagation Conditions | | PCell |  | Clause B.1 | Clause B.1 |
| SCell |  | Clause B.1 | Clause B.1 |
| Correlation Matrix and Antenna | | PCell |  | 1x2 | 2x2 |
| SCell |  | 2x2 | 1x2 |
| Note 1:  for 1x2 and  for 2x2 antenna configuration.  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 | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/15KHz) | | Reference value  Fraction of Maximum  Throughput (%) | | UE Category | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |  |
| 1 | 20 | 20 | R.49 FDD | NA | -85 | -79 | 85 | NA | ≥5 | |
| 2 | 10 | 10 | NA | R.49-1 FDD | -79 | -85.8 | NA | 85 | ≥5 | |
| 3 | 5 | 5 | NA | R.49-2 FDD | -79 | -85.9 | NA | 85 | ≥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. | | | | | | | | | | |

#### 8.2.1.8 Intra-band non-contiguous carrier aggregation with timing offset

The requirements in this section verify the ability of an intraband non-contiguous carrier aggregation UE to demodulate the signal transmitted by the PCell and SCell in the presence of timing offset between the cells. Throughput is measured on both cells.

##### 8.2.1.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.8.1-2, with the addition of the parameters in Table 8.2.1.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.8.1-1: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Modulation | |  | 64 QAM |
| Maximum number of HARQ transmission | |  | 4 |
| Redundancy version coding sequence | |  | {0,0,1,2} |
| PDSCH transmission mode of PCell | |  | 3 |
| PDSCH tramsmission mode of SCell | |  | 3 |
| Note 1: .  Note 2: The OCNG pattern is used to fill unused control channel and PDSCH. | | | |

Table 8.2.1.8.1-2: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Cell | Band-width | Reference Channel | OCNG Pattern | Propagation Conditions | Correlation Matrix and Antenna | Refence value | | Timing relative to PCell (µs) | UE Category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | PCell | 10MHz | R.35-4 FDD | OP.1 FDD | EPA200 | 2x2 Low | 70 | 21.15 | N/A | ≥3 |
| SCell | 10MHz | R.35-3 FDD | EPA200 | 2x2 Low | 60 | 15.18 | -30.26 |
| Note 1: The EPA200 propagation channels applied to PCell and SCell are statistically independent.  Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are 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 and 256QAM | |
| 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 unless otherwise stated | |
| 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 with 2 DL CCs, 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.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.1.1-7, based on single carrier requirement specified in Table 8.2.2.1.1-5, 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 |
| 2 | 10 MHz | R.2 TDD | OP.1 TDD | ETU70 | 1x2 Low | 70 | -0.6 | ≥1 |
| 3 | 10 MHz | R.2 TDD | OP.1 TDD | ETU300 | 1x2 Low | 70 | -0.2 | ≥1 |
| 4 | 10 MHz | R.2 TDD | OP.1 TDD | HST | 1x2 | 70 | -2.6 | ≥1 |
| 5 | 1.4 MHz | R.4 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 0.0 | ≥1 |
| 6 | 10 MHz | R.3 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 6.7 | ≥2 |
| 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 |
| 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 |
| 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 |
| 10 | 5 MHz | R.6 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | 17.6 | ≥2 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 17 | 10 MHz | R.1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 2.0 | ≥1 |
| 18 | 20 MHz | R.1 TDD | OP.1 TDD | ETU70 | 1x2 Low | 30 | 2.1 | ≥1 |
| 19 | 10 MHz | R.41 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -5.3 | ≥1 |
| Note 1: Void. | | | | | | | | |

Table 8.2.2.1.1-3: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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 for Tests in Table 8.2.2.1.1-4; PUCCH format 3 for Tests in Table 8.2.2.1.1-7 |
| 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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 2 | 20MHz+ 15MHz | R.42 TDD for 20MHz CC | OP.1 TDD (Note 1) | EVA5 | 1x2 Low | 70 | -1.4 | ≥5 |
| R.42-3 TDD for 15MHz CC | OP.1 TDD (Note 1) | 70 | -1.4 |
| 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.  Note 3: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC. | | | | | | | | |

Table 8.2.2.1.1-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.4 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -0.6 |
| 3MHz | R.42-1 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -0.8 |
| 5MHz | R.42-2 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -1.2 |
| 10MHz | R.2 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -1.6 |
| 15MHz | R.42-3 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -1.4 |
| 20MHz | R.42 TDD | OP.1 TDD | EVA5 | 1x2 Low | 70 | -1.4 |

Table 8.2.2.1.1-6: Void

Table 8.2.2.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 3x20MHz | As specified in Table 8.2.2.1.1-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.2.1.1-5 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3  Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC. | | | |

##### 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 |

#### 8.2.2.2 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 |
| 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 |

##### 8.2.2.2.2 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 8.2.2.2.2-1: 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 |
| ACK/NACK feedback mode | | | |  | | Multiplexing |
| PDSCH transmission mode | | | |  | | 2 |
| Note 1: | | | | | | |

Table 8.2.2.2.2-2: 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 TDD | OP.1 TDD | EPA5 | 4x2 Medium | 70 | 0.2 | ≥1 |
| 2 | 10 MHz | R.13 TDD | OP.1 TDD | ETU70 | 4x2 Low | 70 | -0.5 | ≥1 |

##### 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 |
| 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. | | | | | | | | | |

##### 8.2.2.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.2.3A-2, with the addition of parameters in Table 8.2.2.2.3A-1. 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 with CRS assistance information. In Table 8.2.2.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.2.2.3A-2 | | 12 | | 10 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 5) | | |  | | N/A | | 0000000001  0000000001 | | 0000000001  0000000001 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 0000000001  0000000001 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A | |
| PDSCH transmission mode | | |  | | 2 | | Note 9 | | Note 9 | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test. | | | | | | | | | | |

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Reference Channel | | OCNG Pattern | | | | | | Propagation Conditions (Note 1) | | | | | | Correlation Matrix and Antenna Configuration (Note 2) | | Reference Value | | | | UE Category | |
| Cell 1 | | Cell 2 | | Cell 3 | | Cell 1 | | Cell 2 | | Cell 3 | | Fraction of Maximum Throughput (%) Note 5 | | SNR (dB) (Note 3) | |
| 1 | | R.11-4 TDD Note 4 | | OP.1TDD | | OP.1TDD | | OP.1TDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Medium | | 70 | | 3.5 | | ≥2 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3..  Note 3: SNR corresponds to of cell 1.  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. | | | | | | | | | | | | | | | | | | | | | | | |

##### 8.2.2.2.4 Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.2.2.4-2, with the addition of parameters in Table 8.2.2.2.4-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.2.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 | | -3 | |
| σ | dB | | 0 | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | | N/A | |
| DIP (Note 2) | | | dB | | N/A | | -1.73 | | -8.66 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Cyclic Prefix | | |  | | Normal | | Normal | | Normal | |
| Cell Id | | |  | | 0 | | 1 | | 2 | |
| Number of control OFDM symbols | | |  | | 2 | | 2 | | 2 | |
| PDSCH transmission mode | | |  | | 2 | | N/A | | N/A | |
| Interference model | | |  | | N/A | | As specified in clause B.5.2 | | As specified in clause B.5.2 | |
| Probability of occurrence of transmission rank in interfering cells | | Rank 1 | % | | N/A | | 80 | | 80 | |
| Rank 2 | % | | N/A | | 20 | | 20 | |
| Reporting interval | | | ms | | 5 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-0 | | N/A | | N/A | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A | |
| Physical channel for CQI reporting | | |  | | PUSCH(Note 5) | | N/A | | N/A | |
| cqi-pmi-ConfigurationIndex | | |  | | 4 | | N/A | | N/A | |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 4: All cells are time-synchronous.  Note 5: 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#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3. | | | | | | | | | | |

Table 8.2.2.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (Note 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SINR (dB) (Note 2) |
| 1 | R.46 TDD | OP.1 TDD | N/A | N/A | EVA70 | EVA70 | EVA70 | 2x2 Low | 70 | -1.4 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.2.2.5 Minimum Requirement 2 Tx Antenna Port (when *EIMTA-MainConfigServCell-r12* is configured)

The requirements are specified in Table 8.2.2.2.5-2 with the addition of the parameters in Table 8.2.2.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The test purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas in case of using eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI on a PCell.

Table 8.2.2.2.5-1: Test Parameters for Transmit diversity Performance (FRC) when   
EIMTA-MainConfigServCell-r12 is configured

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 (Note 1) |
| σ | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Uplink downlink configuration in SIB1 (Note 2) | |  | 0 |
| Downlink HARQ reference configuration (eimta-HarqReferenceConfig-r12) (Note 2) | |  | 5 |
| Set of dynamic TDD UL-DL configurations (Notes 2,3) | |  | {0, 1, 2, 3, 4, 5, 6} |
| Periodicity of monitoring the L1 reconfiguration DCI (eimta-CommandPeriodicity-r12) | | ms | 10 |
| Set of subframes to monitor the L1 reconfiguration DCI (eimta-CommandSubframeSet-r12) (Note 4) | |  | {0,1,5,6} |
| Number of DL HARQ processes | | Processes | 15 |
| PDSCH transmission mode | |  | 2 |
| ACK/NACK feedback mode (Note 5) | |  | Multiplexing |
| Note 1: .  Note 2: As specified in Table 4.2-2 in TS 36.211.  Note 3: UL/DL configuration in PDCCH with eIMTA-RNTI is randomly selected from the given set on a per-DCI basis with equal probability.  Note 4: The set of subframes to monitor PDCCH with eIMTA-RNTI for frame n includes subframes {1,5,6} in frame n-1 and subframe 0 in frame n. Subframes for reconfiguration DCI transmission are chosen in a random way on a per-DCI basis with equal probability.  Note 5: PUCCH Format 3 is used for DL HARQ feedback. | | | |

Table 8.2.2.2.5-2: Minimum performance Transmit diversity when EIMTA-MainConfigServCell-r12 is configured

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Reference channel | OCNG Pattern | Propagation  Conditions | Correlation  Matrix and  Antenna  Configuration | Reference value | | UE  Category |
| Fraction of  Maximum  Throughput  (%) | SNR  (dB) |
| 1 | R.67 TDD | OP.1 TDD | EVA5 | 2x2 Medium | 70 | 5.0 | ≥1 |

##### 8.2.2.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.2.2.6-2, with the addition of parameters in Table 8.2.2.2.6-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.2.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | -3 | -3 | -3 |
|  | dB | -3 (NOTE 1) | -3 | -3 |
| σ | dB | 0 | 0 | 0 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 6 | 1 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | 3 | 3 |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | 2 | 2 |
| PDSCH transmission mode | | |  | 2 | 2 | 2 |
| Interference model | | |  | N/A | As specified in clause B.6.1 | As specified in clause B.6.1 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.2.2.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-12  TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 15.3 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.2.2.7 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.2.2.7-2, with the addition of parameters in Table 8.2.2.2.7-1 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 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.2.2.7-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.7-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | -3 | 0 | 0 |
|  | dB | -3 (NOTE 1) | 0 | 0 |
| σ | dB | 0 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 3.28 | 0.74 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | Random from set {1,2,3} | Random from set {1,2,3} |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | Random from set {1,2} | Random from set {1,2} |
| PDSCH transmission mode | | |  | 2 | 9 | 9 |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| CSI reference signals | | |  | N/A | Antenna ports 15,16 | Antenna ports 15,16 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | N/A | 10 / 4 | 10 / 4 |
| CSI reference signal configuration | | |  | N/A | 6 | 7 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | N/A | 9 /  0100000000000000 | 9 /  0010000000000000 |
| Time offset to cell 1 | | | us | N/A | 5 | -5 |
| Frequency offset to cell 1 | | | Hz | N/A | 600 | -600 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.2.2.2.7-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-11  TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 8.1 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 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 with 2 DL CCs, 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.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.3.1-7, based on single carrier requirement specified in Table 8.2.2.3.1-5, 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 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 1-3 |
| 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 |
| 2 | 10 MHz | R.35 TDD | OP.1 TDD | EVA200 | 2x2 Low | 70 | 20.3 | ≥2 |
| 3 | 10 MHz | R.35-2 TDD | OP.1 TDD | ETU600 | 2x2 Low | 70 | 21.1 | ≥2 |
| Note 1: Void. | | | | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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 for Tests in Table 8.2.2.3.1-4; PUCCH format 3 for Tests in Table 8.2.2.3.1-7 |
| PDSCH transmission mode | |  | 3 |
| Note 1:  Note 2: Void  Note 3: 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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 2 | 20MHz+15MHz | R.30-1 TDD for 20MHz CC | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.0 | ≥5 |
| R.11-9 TDD for 15MHz CC | OP.1 TDD (Note 1) | EVA70 | 70 | 12.9 |
| 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. | | | | | | | | |

Table 8.2.2.3.1-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.11-5 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.2 |
| 3MHz | R.11-6 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 5MHz | R.11-7 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.6 |
| 10 MHz | R.11-8 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 15MHz | R.11-9 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 20MHz | R.30-1 TDD | OP. 1 TDD | EVA70 | 2x2 Low | 70 | 13.0 |

Table 8.2.2.3.1-6: Void

Table 8.2.2.3.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
|
| 1 | 3x20MHz | As specified in Table 8.2.2.3.1-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.2.3.1-5 per CC | ≥5 |
| Note 1: 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 toAnnex 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 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 |
| 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 |
| 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 |
| 2 | 2x20 MHz | R.35-1 TDD | OP.1 TDD (Note 1) | EVA5 | 2x2 Low | 70 | 15.7 | 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. | | | | | | | | |

##### 8.2.2.3.1B Enhanced Performance Requirement Type C - 2Tx Antenna Ports

The requirements are specified in Table 8.2.2.3.1B-2, with the addition of the parameters in Table 8.2.2.3.1B-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.

Table 8.2.2.3.1B-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: | | | | |

Table 8.2.2.3.1B-2: Enhanced Performance Requirement Type C for 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 Medium | 70 | 17.4 | ≥2 |

##### 8.2.2.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.2.3.1C-2, with the addition of parameters in Table 8.2.2.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.2.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.2.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | |
| Bandwidth | | | MHz | | 10 MHz | | | |
| Downlink power allocation |  | | dB | | -3 | | 0 | |
|  | | -3 (Note 1) | | 0 | |
| σ | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna port 0 | |
| Cyclic Prefix | | |  | | Normal | | Normal | |
| Cell ID | | |  | | 0 | | 1 | |
| Transmission mode | | |  | | 3 | | Note 2 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | |
| (Note 3) | | | dB | | Reference Value in Table 8.2.2.3.1C-2 | | 12.95 | |
| Correlation and antenna configuration | | |  | | Medium (2x2) | | Medium(1x2) | |
| Number of OFDM symbols for PDCCH | | |  | | 2 | | N/A | |
| Max number of HARQ transmissions | | |  | | 4 | | N/A | |
| Redundancy version coding sequence | | |  | | {0,1,2,3} | | N/A | |
| Note 1:  Note 2: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.2 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.  Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.  Note 4: All cells are time-synchronous.  Note 5: SIB-1 will not be transmitted in Cell2 in this test. | | | | | | | | |

Table 8.2.2.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | Propagation Conditions (Note 1) | | Reference Value | | UE Category | |
|  | Cell 1 | Cell 2 | Cell 1 | Cell 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 2) |  | |
| 1 | | R.11-10 TDD | OP.1 TDD | OP.5 TDD | EVA70 | EVA70 | 70 | 19.6 | ≥2 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SNR corresponds to  of Cell 1. | | | | | | | | | |

##### 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 |

##### 8.2.2.3.3 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 |
| 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 |
| 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. | | | | | | | | | |

##### 8.2.2.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.4-2, with the addition of parameters in Table 8.2.2.3.4-1. 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 with CRS assistance information. In Table 8.2.2.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.2.3.4-2 | | Reference Value in Table 8.2.2.3.4-2 | | Reference Value in Table 8.2.2.3.4-2 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 1 | | 126 | |
| ABS pattern (Note 5) | | |  | | N/A | | 0000000001  0000000001 | | 0000000001  0000000001 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A | |
| PDSCH transmission mode | | |  | | 3 | | Note 9 | | Note 9 | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.  Note 11: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test. | | | | | | | | | | |

Table 8.2.2.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Number** | | **Reference Channel** | |  | | | | **OCNG Pattern** | | | | | | **Propagation Conditions (Note1)** | | | | | | **Correlation Matrix and Antenna Configuration (Note 2)** | | **Reference Value** | | | | UE Category | |
| **Cell 2** | | **Cell 3** | | **Cell 1** | | **Cell 2** | | **Cell 3** | | **Cell 1** | | **Cell 2** | | **Cell 3** | | Fraction of Maximum Throughput (%) Note 5 | | **SNR (dB) (Note 3)** | |
| 1 | R.11 TDD Note 4 | | 9 | | 7 | | OP.1TDD | | OP.1TDD | | OP.1TDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 70 | | 14.2 | | ≥2 | |
| 2 | R.35 TDD Note 4 | | 9 | | 1 | | OP.1TDD | | OP.1TDD | | OP.1TDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 70 | | 22.7 | | ≥2 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1.  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 |
| 2 | 10 MHz | R.10 TDD | OP.1 TDD | EPA5 | 2x2 High | 70 | -2.8 | ≥1 |

##### 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 |

##### 8.2.2.4.1B Enhanced Performance Requirement Type A – Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1B-2, with the addition of the parameters in Table 8.2.2.4.1B-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 precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.2.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 | | -3 | |
| σ | dB | | 0 | | 0 | | 0 | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | | -98 | | N/A | | N/A | |
| DIP (Note 2) | | | dB | | N/A | | -1.73 | | -8.66 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Cyclic Prefix | | |  | | Normal | | Normal | | Normal | |
| Cell Id | | |  | | 0 | | 1 | | 2 | |
| Number of control OFDM symbols | | |  | | 2 | | 2 | | 2 | |
| PDSCH transmission mode | | |  | | 6 | | N/A | | N/A | |
| Interference model | | |  | | N/A | | As specified in clause B.5.3 | | As specified in clause B.5.3 | |
| Probability of occurrence of transmission rank in interfering cells | | Rank 1 | % | | N/A | | 80 | | 80 | |
| Rank 2 | % | | N/A | | 20 | | 20 | |
| Precoding granularity | | | PRB | | 50 | | 6 | | 6 | |
| PMI delay (Note 4) | | | ms | | 10 or 11 | | N/A | | N/A | |
| Reporting interval | | | ms | | 5 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-1 | | N/A | | N/A | |
| CodeBookSubsetRestriction bitmap | | |  | | 1111 | | N/A | | N/A | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A | |
| Physical channel for CQI reporting | | |  | | PUSCH(Note 6) | | N/A | | N/A | |
| cqi-pmi-ConfigurationIndex | | |  | | 4 | | N/A | | N/A | |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 4: 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 5: All cells are time-synchronous.  Note 6: 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#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3. | | | | | | | | | | |

Table 8.2.2.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (Note 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SINR (dB) (Note 2) |
| 1 | R.47 TDD | OP.1 TDD | N/A | N/A | EVA5 | EVA5 | EVA5 | 2x2 Low | 70 | 1.1 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 8.2.2.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.4.1C-2, with the addition of parameters in Table 8.2.2.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | |
| σ | dB | | 0 | | N/A | | N/A | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 8.2.2.4.1C-2 | | 12 | | 10 | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 5) | | |  | | N/A | | 0000000001 0000000001 | | 0000000001  0000000001 | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | |
| ACK/NACK feeback mode | | |  | | Multiplexing | | N/A | | N/A | |
| PDSCH transmission mode | | |  | | 6 | | Note 9 | | Note 9 | |
| Precoding granularity | | | PRB | | 50 | | N/A | | N/A | |
| PMI delay (Note 10) | | | ms | | 10 or 11 | | N/A | | N/A | |
| Reporting interval | | | ms | | 1 or 4 (Note 11) | | N/A | | N/A | |
| Peporting mode | | |  | | PUSCH 3-1 | | N/A | | N/A | |
| CodeBookSubsetRestriction bitmap | | |  | | 1111 | | N/A | | N/A | |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: 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 11: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.  Note 12: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test. | | | | | | | | | | |

Table 8.2.2.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)– Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note1) | | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) Note 5 | SNR (dB) (Note 3) |
| 1 | R.11 TDD Note 4 | OP.1TDD | OP.1FDD | OP.1TDD | EPA5 | EPA5 | EPA5 | 2x2 High | 70 | 6.4 | ≥2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1.  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. | | | | | | | | | | | |

##### 8.2.2.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1D-2, with the addition of the parameters in Table 8.2.2.4.1D-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 precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.2.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | | Cell 3 | |
| Uplink downlink Configuration | | |  | 1 | 1 | | 1 | |
| Special subframe configuration | | |  | 4 | 4 | | 4 | |
| Downlink power allocation | |  | dB | -3 | -3 | | -3 | |
|  | dB | -3 (NOTE 1) | -3 | | -3 | |
| σ | dB | 0 | 0 | | 0 | |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | | Antenna ports 0,1 | |
| at antenna port | | | dBm/15kHz | -98 | | | | |
| Test number (NOTE 4) | | |  |  | Test 1 | Test 2 | Test 1 | Test 2 |
|  | | | dB | N/A | 13.91 | 3.28 | 3.34 | 0.74 |
| Cell Id | | |  |  | 6 | 1 | 1 | 6 |
| CFI indicated in PCFICH in normal subframes | | |  |  | 3 | Random from set {1,2,3} | 3 | Random from set {1,2,3} |
| CFI indicated in PCFICH in special subframes | | |  |  | 3 | Random from set {1,2} | 3 | Random from set {1,2} |
| BWChannel | | | MHz | 10 | 10 | | 10 | |
| Cyclic Prefix | | |  | Normal | Normal | | Normal | |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | | 3 | |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | | 2 | |
| PDSCH transmission mode | | |  | 4 | 4 | | 4 | |
| Interference model | | |  | N/A | As specified in clause B.6.3 | | As specified in clause B.6.3 | |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.3 | | As specified in clause B.6.3 | |
| Time offset to cell 1 | | | us | N/A | 2 | | 3 | |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | | 300 | |
| MBSFN | | |  | Not configured | Not configured | | Not configured | |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | | {dB-6, dB-3, dB0} | |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | | {2,3,4,8,9} | |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].  NOTE 4: Test 1 and Test 2 are defined in Table 8.2.2.4.1D-2. | | | | | | | | |

Table 8.2.2.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Num | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.11-12  TDD | OP.1 TDD | N/A | N/A | EVA5 | EVA5 | EVA5 | 2x2 Low | 85 | 16.1 | ≥1 |
| 2 | R.11-11  TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 9.5 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

##### 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 | Test 3 |
| 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 | 50 | 8 |
| 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 3-1 | PUSCH 1-2 |
| ACK/NACK feedback mode | | |  | Bundling | Bundling |
| CodeBookSubsetRestriction bitmap | | |  | 110000 | 110000 |
| PDSCH transmission mode | | |  | 4 | 4 |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbol | 2 | 1 |
| 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 | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz | R.35 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 19.5 | ≥2 | ≥6 |
| 2 | 10 MHz | R.11-1 TDD | OP.1 TDD | ETU70 | 2x2 Low | 70 | 13.9 | ≥2 | ≥6 |
| 3 | 20 MHz  256QAM | R. 65 TDD | OP.1 TDD | EVA5 | 2x2 Low | 70 | 24.9 | 11-12 | ≥11 |

##### 8.2.2.4.2A Enhanced Performance Requirement Type C Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2A-2, with the addition of the parameters in Table 8.2.2.4.2A-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 precoding.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| 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 8.2.2.4.2A-2: Enhanced Performance Requirement Type C for 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.11-1 TDD | OP.1 TDD | ETU70 | 2x2 Medium | 70 | 17.8 | ≥2 |

##### 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 with 2 DL CCs, the requirements are specified in Table 8.2.2.4.3-4, with the addition of the parameters in Table 8.2.2.4.3-3 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.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.4.3-7, based on single carrier requirement specified in Table 8.2.2.4.3-5, with the addition of the parameters in Table 8.2.2.4.3-3 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 8.2.2.4.3-1: 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 |
| Note 1: Void | | | | | | | | |

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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 for Tests in Table 8.2.2.4.3-4; PUCCH format 3 for Tests in Table 8.2.2.4.3-7 |
| 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 with 2DL CCs

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 2 | 20MHz+15MHz | R.43 TDD for 20MHz CC | OP.1 TDD (Note 1) | EVA5 | 4x2 Low | 70 | 10.7 | ≥5 |
| R.43-5 TDD for 15MHz CC | OP.1 TDD (Note 1) | 10.6 |
| 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. | | | | | | | | |

Table 8.2.2.4.3-5: Single carrier performance for multiple CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.43-1 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 11.0 |
| 3MHz | R.43-2 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 9.8 |
| 5MHz | R.43-3 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.0 |
| 10 MHz | R.43-4 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.5 |
| 15MHz | R.43-5 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.6 |
| 20MHz | R.43 TDD | OP. 1 TDD | EVA5 | 4x2 Low | 70 | 10.7 |

Table 8.2.2.4.3-6: Void

Table 8.2.2.4.3-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | CA Band-width combination | Requirement | UE category |
| 1 | 3x20MHz | As specified in Table 8.2.2.4.3-5 per CC | ≥5 |
| 2 | 20MHz+20MHz+15MHz | As specified in Table 8.2.2.4.3-5 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3 | | | |

##### 8.2.2.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.2.4.3A-3, based on single carrier requirement specified in Table 8.2.2.4.3A-2, with the addition of the parameters in Table 8.2.2.4.3A-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 by using dual connectivity.

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | 6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs |
| PMI delay (Note 2) | | ms | 10 or 11 |
| Reporting interval | | ms | 1 or 4 (Note 3) |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| PDSCH transmission mode | |  | 4 |
| ACK/NACK transmission | |  | Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG |
| CSI feedback | |  | Separate PUSCH feedbacks on the MCG and SCG |
| Time offset between MCG CC and SCG CC | | μs | 0 for UE under test supporting synchronous dual connectivity;  334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 5) |
| 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: The same PDSCH transmission mode is applied to each component carrier.  Note 5: As defined in TS36.300 [11].  Note 6: If the UE supports both SCG bearer and Split bearer, the SCG bearer is configured. | | | |

Table 8.2.2.4.3A-2: Single carrier performance for multiple dual connectivity configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference channel | OCNG pattern | Propa-gation condi-tion | Correlation matrix and antenna config. | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1.4MHz | R.43-1 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 11.0 |
| 3MHz | R.43-2 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 9.8 |
| 5MHz | R.43-3 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.0 |
| 10 MHz | R.43-4 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.5 |
| 15MHz | R.43-5 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.6 |
| 20MHz | R.43 TDD | OP. 1 TDD | EVA5 | 4x2 Low | 70 | 10.7 |

Table 8.2.2.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

|  |  |  |  |
| --- | --- | --- | --- |
| Test num. | Band-width combination | Requirement | UE category |
|
| 1 | 2x20 MHz | As specified in Table 8.2.2.4.3A-2 per CC | ≥5 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability of requirements for different dual connectivity configurations and bandwidth combination sets is defined in 8.1.2.3A. | | | |

##### 8.2.2.4.4 Void

#### 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 adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell 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 | Test 2 |
| Downlink power allocation |  | | dB | 0 | 0 |
|  | | dB | 0 (Note 1) | 0 (Note 1) |
| σ | | dB | 0 | 0 |
| at antenna port | | | dBm/15kHz | Off (Note 2) | Off (Note 2) |
| Symbols for unused PRBs | | |  | OCNG (Note 3) | OCNG (Note 3) |
| Modulation | | |  | 64 QAM | 64 QAM |
| Maximum number of HARQ transmission | | |  | 1 | 1 |
| Redundancy version coding sequence | | |  | {0} | {0} |
| PDSCH transmission mode of PCell | | |  | 1 | 3 |
| PDSCH transmission mode of SCell | | |  | 3 | 1 |
| OCNG Pattern | | PCell |  | OP.1 TDD | OP.5 TDD |
| SCell |  | OP.5 TDD | OP.1 TDD |
| Propagation Conditions | | PCell |  | Clause B.1 | Clause B.1 |
| SCell |  | Clause B.1 | Clause B.1 |
| Correlation Matrix and Antenna | | PCell |  | 1x2 | 2x2 |
| SCell |  | 2x2 | 1x2 |
| Note 1:  for 1x2 and  for 2x2 antenna configuration.  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 8.2.2.7.1-2: Minimum performance (FRC) for CA

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/15KHz) | | Reference value  Fraction of Maximum  Throughput (%) | | UE Category | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |  |
| 1 | 20 | 20 | R.49 TDD | NA | -85 | -79 | 85 | NA | ≥5 | |
| 2 | 20 | 15 | NA | R.49-1 TDD | -79 | -85.8 | NA | 85 | ≥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. | | | | | | | | | | |

#### 8.2.2.8 Intra-band contiguous carrier aggregation with minimum channel spacing

The requirements in this section verify the ability of an UE supporting intraband contiguous carrier aggregation with minimum channel spacing to demodulate the signal transmitted by the PCell and SCell(s). Throughput is measured on each cell. The minimum channel spacing of intra-band contiguous carrier aggregation refers to the possible minimum channel spacing as any multiple of 300 kHz less than the nominal channel spacing defined in 5.7.1A.

##### 8.2.2.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.8.1-2, with the addition of the parameters in Table 8.2.2.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.8.1-1: 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 | |  | 64QAM |
| ACK/NACK feedback mode | |  | PUCCH format 1b with channel selection for Test 1; PUCCH format 3 for Test 2 |
| 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 8.2.2.8.1-2: Minimum performance (FRC) for intra-band CA with minimum channel spacing

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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.9 TDD | OP.1 TDD (Note 1) | EVA5 | 1x2 Low | 70 | 17.16 | ≥5 |
| R.9 TDD | OP.1 TDD (Note 1) | 70 | 17.16 |
| 2 | 3x20MHz | R.9 TDD | OP.1 TDD (Note 1) | EVA5 | 1x2 Low | 70 | 17.16 | ≥5 |
| R.9 TDD | OP.1 TDD (Note 1) | 70 | 17.16 |
| R.9 TDD | OP.1 TDD (Note 1) | 70 | 17.16 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3. | | | | | | | | |

### 8.2.3 TDD FDD CA (Fixed Reference Channel)

The parameters specified in Table 8.2.3-1 are valid for all the TDD FDD CA tests unless otherwise stated.

Table 8.2.3-1: Common Test Parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Value | | |
| Uplink downlink configuration (Note 1) for TDD CC only | | | |  | 1 | |
| Special subframe configuration (Note 2) for TDD CC only | | | |  | 4 | |
| Inter-TTI Distance | | | |  | 1 | |
| Maximum number of HARQ processes per component carrier | | FDD PCell | | Processes | 8 for FDD and TDD CCs | |
| TDD PCell | | Processes | 11 for FDD CC; 7 for TDD CC | |
| 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 | |
| ACK/NACK feedback mode | | | |  | PUCCH format 3 | |
| Downlink HARQ-ACK timing | | FDD PCell | |  | As specified in Clause 7.3.3 in TS36.213 [6] | |
| TDD PCell | |  | As specified in Clause 7.3.4 in TS36.213 [6] | |
| 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]. | | | | | | |

The applicability of ther requirements are specified in Clause 8.1.2.3. The single carrier performance with different bandwidths for multiple CA configurations specified in Clause 8.2.3 cannot be applied for UE single carrier test.

#### 8.2.3.1 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.

##### 8.2.3.1.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.1-4 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.1.1-5 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 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 8.2.3.1.1-1: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.1.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.4 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.3 |
| 3 MHz | R.42-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.1 |
| 5MHz | R.42-2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 |
| 10MHz | R.2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |
| 15MHz | R.42-3 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.6 |
| 20MHz | R.42 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |

Table 8.2.3.1.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band-width | | Reference Channel | | OCNG Pattern | | Propagation Condition | | Correlation Matrix and Antenna Configuration | | Reference value | | | |
| Fraction of Maximum  Throughput (%) | | SNR (dB) | |
| 1.4 MHz | | R.4 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -0.6 | |
| 3 MHz | | R.42-1 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -0.8 | |
| 5MHz | | R.42-2 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.2 | |
| 10MHz | | R.2 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.6 | |
| 15MHz | | R.42-3 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.4 | |
| 20MHz | | R.42 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.4 | |

Table 8.2.3.1.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **CA Bandwidth combination (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.  Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any FDD CC. | | | | | |

Table 8.2.3.1.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **CA Bandwidth combination (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.  Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any FDD CC. | | | | | |

##### 8.2.3.1.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.2-4 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 3DL CCs, the requirements are specified in Table 8.2.3.1.2-5 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 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 8.2.3.1.2-1: Test Parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.1.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.4 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.3 |
| 3 MHz | R.42-1 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.1 |
| 5MHz | R.42-2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.0 |
| 10MHz | R.2 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |
| 15MHz | R.42-3 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.6 |
| 20MHz | R.42 FDD | OP.1 FDD | EVA5 | 1x2 Low | 70 | -1.7 |

Table 8.2.3.1.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band-width | | Reference Channel | | OCNG Pattern | | Propagation Condition | | Correlation Matrix and Antenna Configuration | | Reference value | | | |
| Fraction of Maximum  Throughput (%) | | SNR (dB) | |
| 1.4 MHz | | R.4 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -0.6 | |
| 3 MHz | | R.42-1 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -0.8 | |
| 5MHz | | R.42-2 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.2 | |
| 10MHz | | R.2 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.6 | |
| 15MHz | | R.42-3 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.4 | |
| 20MHz | | R.42 TDD | | OP.1 TDD | | EVA5 | | 1x2 Low | | 70 | | -1.4 | |

Table 8.2.3.1.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B  Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any TDD CC. | | | | | |

Table 8.2.3.1.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.  Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any TDD CC. | | | | | |

#### 8.2.3.2 Open-loop spatial multiplexing performance 2Tx Antenna port

##### 8.2.3.2.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.1-4 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 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 TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.1-5 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 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.

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

Table 8.2.3.2.1-1: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.2.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.11-5 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 13.6 |
| 3 MHz | R.11-6 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 5MHz | R.11-2 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 10MHz | R.11 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 15MHz | R.11-7 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 20MHz | R.30 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |

Table 8.2.3.2.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.11-5 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.2 |
| 3 MHz | R.11-6 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 5MHz | R.11-7 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.6 |
| 10MHz | R.11-8 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 15MHz | R.11-9 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 20MHz | R.30-1 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.0 |

Table 8.2.3.2.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B | | | | | |

Table 8.2.3.2.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B. | | | | | |

##### 8.2.3.2.1A Soft buffer management test for FDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.1A-2, with the addition of the parameters in Table 8.2.3.2.1A-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 for FDD as PCell.

Table 8.2.3.2.1A-1: Test Parameters for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | |
| FDD Carrier | TDD Carrier |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 (Note 1) | -3 (Note 1) |
| σ | dB | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| PDSCH transmission mode | |  | 3 | 3 |
| Note 1: .  Note 2: The same PDSCH transmission mode is applied to each component carrier. | | | | |

Table 8.2.3.2.1A-2: 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 | PCell | 20MHz | R.30 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 3 |
| SCell | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1) | 70 | 13.2 |
| 2 | PCell | 20MHz | R.35-1 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.3 | 4 |
| SCell | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | 70 | 16.3 |
| 3 | PCell | 10MHz | R.35-3 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.0 | 3 |
| SCell | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1) | 70 | 13.2 |
| 4 | PCell | 10MHz | R.35-3 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.0 | 4 |
| SCell | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | 70 | 16.3 |
| 5 | PCell | 15MHz | R.35-2 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.0 | 3 |
| SCell | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1) | 70 | 13.2 |
| 6 | PCell | 15MHz | R.35-2 FDD | OP.1 FDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.0 | 4 |
| SCell | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | 70 | 16.3 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B. | | | | | | | | | |

##### 8.2.3.2.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.2-4 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.2-5 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

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

Table 8.2.3.2.2-1: Test Parameters for Large Delay CDD (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| 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: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.2.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.11-5 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 13.6 |
| 3 MHz | R.11-6 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 5MHz | R.11-2 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.3 |
| 10MHz | R.11 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 15MHz | R.11-7 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 20MHz | R.30 FDD | OP.1 FDD | EVA70 | 2x2 Low | 70 | 12.9 |

Table 8.2.3.2.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.11-5 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.2 |
| 3 MHz | R.11-6 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 5MHz | R.11-7 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.6 |
| 10MHz | R.11-8 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.8 |
| 15MHz | R.11-9 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 12.9 |
| 20MHz | R.30-1 TDD | OP.1 TDD | EVA70 | 2x2 Low | 70 | 13.0 |

Table 8.2.3.2.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B | | | | | |

Table 8.2.3.2.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B. | | | | | |

##### 8.2.3.2.2A Soft buffer management test for TDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.2A-2, with the addition of the parameters in Table 8.2.3.2.2A-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 for TDD as PCell.

Table 8.2.3.2.2A-1: Test Parameters for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | |
| FDD Carrier | TDD Carrier |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 (Note 1) | -3 (Note 1) |
| σ | dB | 0 | 0 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| PDSCH transmission mode | |  | 3 | 3 |
| Note 1: .  Note 2: The same PDSCH transmission mode is applied to each component carrier. | | | | |

Table 8.2.3.2.2A-2: 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 | **PCell** | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1)) | EVA70 | 2x2 Low | 70 | 13.2 | 3 |
| **SCell** | 20MHz | R.30 FDD | OP.1 FDD (Note 1 | 70 | 13.2 |
| 2 | **PCell** | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.2 | 4 |
| **SCell** | 20MHz | R.35-1 FDD | OP.1 FDD (Note 1) | 70 | 16.2 |
| 3 | **PCell** | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 3 |
| **SCell** | 10MHz | R.35-3 FDD | OP.1 FDD (Note 1) | 70 | 16.0 |
| 4 | **PCell** | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.2 | 4 |
| **SCell** | 10MHz | R.35-3 FDD | OP.1 FDD (Note 1) | 70 | 15.8 |
| 5 | **PCell** | 20MHz | R.30-2 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 13.2 | 3 |
| **SCell** | 15MHz | R.35-2 FDD | OP.1 FDD (Note 1) | 70 | 15.8 |
| 6 | **PCell** | 20MHz | R.35-1 TDD | OP.1 TDD (Note 1) | EVA70 | 2x2 Low | 70 | 16.2 | 4 |
| **SCell** | 15MHz | R.35-2 FDD | OP.1 FDD (Note 1) | 70 | 15.8 |
| Note 1: The OCNG pattern applies for each CC.  Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B. | | | | | | | | | |

#### 8.2.3.3 Closed-loop spatial multiplexing performance 4Tx Antenna Port

##### 8.2.3.3.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.1-4 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.1-5 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-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 8.2.3.3.1-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | Wideband precoding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs |
| PMI delay (Note 2) | FDD CC | ms | 8 |
| TDD CC | ms | 10 or 11 |
| Reporting interval | FDD CC | ms | 1 |
| TDD CC | ms | 1 or 4 (Note 3) |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 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 3.  Note 5: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.3.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.14-4 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.4 |
| 3 MHz | R.14-5 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 5MHz | R.14-6 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 10MHz | R.14 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 15MHz | R.14-7 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 20MHz | R.14-3 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.3 |

Table 8.2.3.3.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.43-1 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 11.0 |
| 3 MHz | R.43-2 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 9.8 |
| 5MHz | R.43-3 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.0 |
| 10MHz | R.43-4 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.5 |
| 15MHz | R.43-5 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.6 |
| 20MHz | R.43 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.7 |

Table 8.2.3.3.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B | | | | | |

Table 8.2.3.3.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B | | | | | |

##### 8.2.3.3.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.2-4 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 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.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.2-5 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 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.

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

Table 8.2.3.3.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Downlink power allocation |  | dB | -6 |
|  | dB | -6 (Note 1) |
| σ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Precoding granularity | | PRB | Widelband pre-coding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs |
| PMI delay (Note 2) | FDD CC | ms | 8 |
| TDD CC | ms | 10 or 11 |
| Reporting interval | FDD CC | ms | 1 |
| TDD CC | ms | 1 or 4 (Note 3) |
| Reporting mode | |  | PUSCH 1-2 |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000011111111111111110000000000000000 |
| CSI request field (Note 3) | |  | ‘10’ |
| PDSCH transmission mode | |  | TM4 |
| 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 3.  Note 5: The same PDSCH transmission mode is applied to each component carrier. | | | |

Table 8.2.3.3.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.14-4 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.4 |
| 3 MHz | R.14-5 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 5MHz | R.14-6 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 9.5 |
| 10MHz | R.14 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 15MHz | R.14-7 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.1 |
| 20MHz | R.14-3 FDD | OP.1 FDD | EVA5 | 4x2 Low | 70 | 10.3 |

Table 8.2.3.3.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Band-width | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1.4 MHz | R.43-1 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 11.0 |
| 3 MHz | R.43-2 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 9.8 |
| 5MHz | R.43-3 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.0 |
| 10MHz | R.43-4 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.5 |
| 15MHz | R.43-5 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.6 |
| 20MHz | R.43 TDD | OP.1 TDD | EVA5 | 4x2 Low | 70 | 10.7 |

Table 8.2.3.3.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Aggregated Bandwidth (MHz) | | | Minimum performance requirement | UE Category |
| Total | FDD CC | TDD CC |
| 1 | 2x20 | 20 | 20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| 2 | 20+10 | 10 | 20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| 3 | 20+15 | 15 | 20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B | | | | | |

Table 8.2.3.3.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Aggregated Bandwidth (MHz)** | | | **Minimum performance requirement** | **UE Category** |
| **Total** | **FDD CC** | **TDD CC** |
| 1 | 3x20 | 20 | 2x20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| 2 | 20+20+15 | 15 | 2x20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| 3 | 20+20+10 | 10 | 2x20 | As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC | ≥5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B. | | | | | |

## 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 and 256QAM | |
| Number of OFDM symbols for PDCCH | | | OFDM symbols | 2 | |
| Precoder update granularity | | |  | Frequency domain: 1 PRG for Transmission modes 9 and 10  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 | Test 3 |
| Downlink power allocation |  | dB | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | -3 | -3 | -3 |
| Beamforming model | |  | Annex B.4.1 | Annex B.4.1 | Annex B.4.1 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | |
| CSI reference signals | |  | Antenna ports 15,…,18 | Antenna ports 15,…,18 | Antenna ports 15, …, 18 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 | 5 / 2 | 5 / 2 |
| CSI reference signal configuration | |  | 0 | 3 | 0 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 3 /  0001000000000000 | 3 /  0001000000000000 | 3 /  0001000000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | 50 | 50 |
| Simultaneous transmission | |  | No | Yes (Note 3, 5) | No |
| PDSCH transmission mode | |  | 9 | 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 | UE DL Cat-egory |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.43 FDD | OP.1 FDD | EVA5 | 2x2 Low | 70 | -1 | ≥1 | ≥6 |
| 3 | 10MHz  256QAM | R. 66 FDD | OP.1 FDD | EPA5 | 2x2 Low | 70 | 24.3 | 11-12 | ≥11 |

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 |
| Note 1: The reference channel applies to both the input signal under test and the interfering signal. | | | | | | | | |

#### 8.3.1.1A Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1A-2, with the addition of the parameters in Table 8.3.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.1.1A-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.3.1.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports 15,…,18 | N/A |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 | N/A |
| CSI reference signal configuration | |  | 0 | N/A |
| at antenna port | | dBm/15kHz | -98 | N/A |
| DIP (Note 2) | | dB | N/A | -1.73 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 126 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 9 | N/A |
| Beamforming model | |  | As specified in clause B.4.3  (Note 4, 5) | N/A |
| Interference model | |  | N/A | As specified in clause B.5.4 |
| Probability of occurrence of transmission rank in interfering cells | Rank 1 |  | N/A | 70 |
| Rank 2 |  | N/A | 30 |
| Precoder update granularity | | PRB | 50 | 6 |
| PMI delay (Note 5) | | Ms | 8 | N/A |
| Reporting interval | | Ms | 5 | N/A |
| Reporting mode | |  | PUCCH 1-1 | N/A |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000000000000000000001111111111111111 | N/A |
| Symbols for unused PRBs | |  | OCNG (Note 6) | N/A |
| Simultaneous transmission | |  | No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test | N/A |
| Physical channel for CQI reporting | |  | PUSCH(Note 8) | N/A |
| cqi-pmi-ConfigurationIndex | |  | 5 | N/A |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.  Note 4: The precoder in clause B.4.3 follows UE recommended PMI.  Note 5: 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 6: 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 7: All cells are time-synchronous.  Note 8: 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#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3. | | | | |

Table 8.3.1.1A-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Reference Channel | | OCNG Pattern | | | | Propagation Conditions | | | | Correlation Matrix and Antenna Configuration (Note 3) | | Reference Value | | | | UE Category | |
| Cell 1 | | Cell 2 | | Cell 1 | | Cell 2 | | Fraction of Maximum Throughput (%) | | SINR (dB) (Note 2) | |
| 1 | R.48 FDD | | OP.1 FDD | | N/A | | EVA5 | | EVA5 | | 4x2 Low | | 70 | | -1.1 | | ≥1 | |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2. | | | | | | | | | | | | | | | | | | |

#### 8.3.1.1B Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.1.1B -2, with the addition of parameters in Table 8.3.1.1B-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.1.1B-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.1.1B-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | | |
| Downlink power allocation | |  | dB | | 0 | | -3 | | -3 | | |
|  | dB | | 0 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | | |
| σ | dB | | -3 | | N/A | | N/A | | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | | |
|  | | | dB | | Reference Value in Table 8.3.1.1B-2 | | 12 | | 10 | | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | | |
| Cell Id | | |  | | 0 | | 1 | | 126 | | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | | | | | |
| CSI reference signals | | |  | | Antenna ports 15,16 | | N/A | | N/A | | |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | | 5 / 2 | | N/A | | N/A | | |
| CSI reference signal configuration | | |  | | 8 | | N/A | | N/A | | |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | | 3 /  0010000000000000 | | N/A | | N/A | | |
| ABS pattern (Note 5) | | |  | | N/A | | 11000000  11000000  11000000  11000000  11000000 | | 11000000  11000000  11000000  11000000  11000000 | | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 11000000 11000000 11000000 11000000 11000000 | | N/A | | N/A | | |
| CCSI,1 |  | | 00111111 00111111 00111111 00111111 00111111 | | N/A | | N/A | | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | | |
| PDSCH transmission mode | | |  | | TM9-1layer | | Note 9 | | Note 9 | | |
| Precoding granularity | | |  | | Frequency domain: 1 PRG  Time domain: 1 ms | | N/A | | N/A | | |
| Beamforming model | | |  | | Annex B.4.1 | | N/A | | N/A | | |
| Cyclic prefix | | |  | | Normal | | 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]. 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 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: 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 11: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 12: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.  Note 13: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8. | | | | | | | | | | |

Table 8.3.1.1B-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note1) | | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.51 FDD | OP.1FDD | OP.1FDD | OP.1FDD | EVA5 | | | 2x2 Low | 70 | 7.8 | ≥2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | |

#### 8.3.1.1C Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1C-2, with the addition of the parameters in Table 8.3.1.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7, 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.1.1C-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1C-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (NOTE 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH | | |  | 3 | 3 | 3 |
| PDSCH transmission mode | | |  | 9 | 9 | 9 |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.4 | As specified in clause B.6.4 |
| CSI reference signals | | |  | Antenna ports 15, 16, 17, 18 | Antenna ports 15, 16 | Antenna ports 15, 16 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | 10 / 1 | 10 / 1 | 10 / 1 |
| CSI reference signal configuration | | |  | 5 | 6 | 7 |
| Zero-power CSI-RS configuration  *I*CSI-RS /*ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | 6 /  1000000000000000 | 6 /  0100000000000000 | 6 /  0010000000000000 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.1.1C-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration | | | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.69 FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 4x2 Low | 2x2 Low | 2x2 Low | 85 | 18.5 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | | | | | | | | | | | |

#### 8.3.1.1D Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.1.1D-2, with the addition of the parameters in Table 8.3.1.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.1.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (NOTE 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH | | |  | 3 | 3 | 3 |
| PDSCH transmission mode | | |  | 8 | N/A | N/A |
| Interference model | | |  | N/A | As specified in clause B.6.5 | As specified in clause B.6.5 |
| Precoding | | |  | Random wideband precoding per TTI | N/A | N/A |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.1.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.71 FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 14.3 | ≥2 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 8.3.1.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference model

The requirements are specified in Table 8.3.1.1E-2, with the addition of the parameters in Table 8.3.1.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.1.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | |  | dB | 0 | -3 | -3 |
|  | dB | 0 (NOTE 1) | -3 | -3 |
| σ | dB | -3 | 0 | 0 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 3.28 | 0.74 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH | | |  | 3 | Random from {1,2,3} | Random from {1,2,3} |
| PDSCH transmission mode | | |  | 8 | 3 | 3 |
| Interference model | | |  | N/A | As specified in clause B.6.2 | As specified in clause B.6.2 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.2 | As specified in clause B.6.2 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.1.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.70 FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 11.5 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 8.3.1.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.1.1F-2, with the addition of the parameters in Table 8.3.1.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.1.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM10 serving cell configuration and TM9 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH | | |  | 3 | 3 | 3 |
| PDSCH transmission mode | | |  | 10 | 9 | 9 |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.4 | As specified in clause B.6.4 |
| CSI reference signals | | |  | Antenna ports 15, 16, 17, 18 | Antenna ports 15, 16 | Antenna ports 15, 16 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | 10 / 1 | 10 / 1 | 10 / 1 |
| CSI reference signal configuration | | |  | 5 | 6 | 7 |
| Zero-power CSI-RS configuration  *I*CSI-RS /*ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | 6 /  1000000000000000 | 6 /  0100000000000000 | 6 /  0010000000000000 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (Note 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| Note 1:  Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.1.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM10 serving cell configuration and TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration | | | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 2) |
| 1 | R.69 FDD | OP.1 FDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 4x2 Low | 2x2 Low | 2x2 Low | 85 | 18.2 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | | | | | | | | | | | |

#### 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 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

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 | |
| Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| PDSCH\_RA | dB | 4 | N/A |
| PDSCH\_RB | dB | 4 | N/A |
| Cell-specific reference signals | |  | Antenna ports 0 and 1 | Antenna ports 0 and 1 |
| Cell ID | |  | 0 | 126 |
| CSI reference signals | |  | Antenna ports 15,16 | NA |
| Beamforming model | |  | Annex B.4.2 | NA |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 | NA |
| CSI reference signal configuration | |  | 8 | NA |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 3 /  0010000000000000 | NA |
| at antenna port | | dBm/15kHz | -98 | -98 |
|  | |  | Reference Value in Table 8.3.1.2-2 | 7.25dB |
| Symbols for unused PRBs | |  | OCNG (Note 2) | NA |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | NA |
| Simultaneous transmission | |  | No | NA |
| PDSCH transmission mode | |  | 9 | Blanked |
| 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** |
| **Cell1** | **Cell 2** | **Cell 1** | **Cell 2** | **Fraction of Maximum**  **Throughput (%)** | **SNR (dB)** |
| 1 | 10 MHz  16QAM 1/2 | R.51 FDD | OP.1 FDD | N/A | ETU5 | ETU5 | 2x2 Low | 70 | 14.2 | ≥2 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.  Note 3: SNR corresponds to  of Cell 1. | | | | | | | | | | |

#### 8.3.1.2A Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing

The requirements are specified in Table 8.3.1.2A-2, with the addition of the parameters in Table 8.3.1.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of this test is to verify rank two performance for full RB allocation upon antenna ports 7 and 8.

Table 8.3.1.2A-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 8.3.1.2A-2: Enhanced Performance Requirement Type C 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 Medium | 70 | 17.4 | ≥2 |

#### 8.3.1.3 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

##### 8.3.1.3.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.1-3, with the additional parameters in Table 8.3.1.3.1-1 and Table 8.3.1.3.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ (PQI) signalling defined in [6], configured according to Table 8.3.1.3.1-2. In Tables 8.3.1.3.1-1 and 8.3.1.3.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.1-1: Test Parameters for quasi co-location type B: same Cell ID

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | (Note 2) |
| CSI-RS 0 antenna ports | |  | NA | Port {15,16} |
| *qcl-CSI-RS-ConfigNZPId-r11,* CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | NA | 5/2 |
| *qcl-CSI-RS-ConfigNZPId-r11,* CSI-RS 0 configuration | |  | NA | 8 |
| *csi-RS-ConfigZPId-r11,* Zero-power CSI-RS 0 configuration *I*CSI-RS / *ZeroPower CSI-RS* bitmap | |  | NA | 2/  0000010000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 |
|  | | dB | Reference point in Table 8.3.1.3.1-3 | Reference point in Table 8.3.1.3.1-3 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 0 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | Blanked | 10 |
| Number of allocated PRB | | PRB | NA | 50 |
| *qcl-Operation, ‘*PDSCH RE Mapping and Quasi-Co-Location Indicator’ | |  | Type B, ‘00’ | |
| Time offset between TPs | | μs | NA | Reference point in Table 8.3.1.3.1-3 |
| Frequency error between TPs | | Hz | NA | 0 |
| Beamforming model | |  | NA | Port 7 as specified in clause B.4.1 |
| Symbols for unused PRBs | |  | NA | OCNG (Note 3) |
| Note 1:  Noet 2: REs for antenna ports 0 and 1 have zero transmission power.  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, which is QPSK modulated. | | | | |

Table 8.3.1.3.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PQI set index | Parameters in each PQI set | | DL transmission hypothesis for each PQI Set | |
| NZP CSI-RS Index (For quasi co-location) | ZP CSI-RS configuration | TP 1 | TP 2 |
| PQI set 0 | CSI-RS 0 | ZP CSI-RS 0 | Blanked | PDSCH |

Table 8.3.1.3.1-3: Minimum performance for quasi co-location type B: same Cell ID

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OGCN pattern | | Time offset between TPs (μs) | Propagation Conditions (Note1) | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.52 FDD | NA | OP.1 FDD | 2 | EPA5 | EPA5 | 2x2 Low | 70 | 12.1 | ≥2 |
| 2 | R.52 FDD | NA | OP.1 FDD | -0.5 | EPA5 | EPA5 | 2x2 Low | 70 | 12.6 | ≥2 |
| Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.  Note 3: SNR corresponds to of TP 2 as defined in clause 8.1.1. | | | | | | | | | | |

##### 8.3.1.3.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.1.3.2-3, with the additional parameters in Tables 8.3.1.3.2-1 and 8.3.1.3.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ (PQI) signalling defined in [6]. In Tables 8.3.1.3.2-1 and 8.3.1.3.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.2-1: Test Parameters for timing offset compensation with DPS transmission

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Beamforming model | |  | As specified in clause B.4.1 | As specified in clause B.4.1 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | (Note 2) |
| CSI reference signals 0 | |  | Antenna ports {15,16} | N/A |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 | N/A |
| CSI reference signal 0 configuration | |  | 0 | N/A |
| CSI reference signals 1 | |  | N/A | Antenna ports {15,16} |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | N/A | 5 / 2 |
| CSI reference signal 1 configuration | |  | N/A | 8 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmap | | Subframes/bitmap | 2/  0010000000000000 | N/A |
| Zero-power CSI-RS1 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmapS | | Subframes/bitmap | N/A | 2/  0000010000000000 |
|  | | dB | Reference Value in Table 8.3.1.3.2-3 | Reference Value in Table 8.3.1.3.2-3 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 0 |
| Number of control OFDM symbols | |  | 2 | 2 |
| Timing offset between TPs | |  | N/A | Reference Value in Table 8.3.1.3.2-3 |
| Frequency offset between TPs | | Hz | N/A | 0 |
| Number of allocated resource blocks | | PRB | 50 | 50 |
| PDSCH transmission mode | |  | 10 | 10 |
| Probability of occurrence of PDSCH transmission(Note 3) | | % | 30 | 70 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) |
| Note 1:  Note 2: REs for antenna ports 0 and 1 have zero transmission power.  Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.  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. | | | | |

Table 8.3.1.3.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PQI set index | Parameters in each PQI set | | DL transmission hypothesis for each PQI Set | |
| NZP CSI-RS Index (For quasi co-location) | ZP CSI-RS configuration | TP 1 | TP 2 |
| PQI set 0 | CSI-RS 0 | ZP CSI-RS 0 | PDSCH | Blanked |
| PQI set 3 | CSI-RS 1 | ZP CSI-RS 1 | Blanked | PDSCH |

Table 8.3.1.3.2-3: Performance Requirements for timing offset compensation with DPS transmission

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Timing offset(us) | Reference Channel | OCNG Pattern | | Propagation Conditions | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
|  | TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | 2 | R.53 FDD | OP.1 FDD | OP.1 FDD | EPA5 | EPA5 | 2x2 Low | 70 | 12.2 | ≥2 |
| 2 | -0.5 | R.53 FDD | OP.1 FDD | OP.1 FDD | EPA5 | EPA5 | 2x2 Low | 70 | 12.5 | ≥2 |
|  | | | | | | | | | | |
| Note 1: The propagation conditions for TP 1and TP 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.  Note 3: SNR corresponds to  of both TP 1 and TP 2 as defined in clause 8.1.1. | | | | | | | | | | |

##### 8.3.1.3.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.3-2, with the additional parameters in Table 8.3.1.3.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ signalling defined in [6]. In Table 8.3.1.3.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Beamforming model | |  | N/A | As specified in clause B.4.2 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| CSI reference signals 0 | |  | N/A | Antenna ports {15,16} |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | N/A | 5 / 2 |
| CSI reference signal 0 configuration | |  | N/A | 0 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmap | | Subframes/bitmap | N/A | 2/  0010000000000000 |
|  | | dB | Reference point in Table 8.3.1.3.3-2 + 4dB | Reference Value in Table 8.3.1.3.3-2 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 126 |
| Number of control OFDM symbols | |  | 1 | 2 |
| Timing offset between TPs | | us | N/A | 0 |
| Frequency offset between TPs | | Hz | N/A | 200 |
| *qcl-Operation, ‘*PDSCH RE Mapping and Quasi-Co-Location Indicator’ | |  | Type B, ‘00’ | |
| PDSCH transmission mode | |  | Blank | 10 |
| Number of allocated resource block | |  | N/A | 50 |
| Symbols for unused PRBs | |  | N/A | OCNG(Note2) |
| 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 8.3.1.3.3-2: Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Reference Channel | OCNG Pattern | | Propagation Conditions (Note1) | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.54 FDD | | N/A | OP.1FDD | EPA5 | ETU5 | 2x2 Low | 70 | 14.4 | ≥2 |
| Note 1: The propagation conditions for TP.1 and TP.2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1 and TP.2.  Note 3: SNR corresponds to  of TP.2 as defined in clause 8.1.1. | | | | | | | | | | |

### 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 and 256QAM | |
| Number of OFDM symbols for PDCCH | | | OFDM symbols | 2 | |
| Precoder update granularity | | |  | Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission modes 9 and 10  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 |
| 2 | 10 MHz  16QAM 1/2 | R.26 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 7.0 | ≥2 |
| 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 |
| 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 |

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 |
| 2 | 10 MHz  16QAM 1/2 | R.32 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 7.7 | ≥2 |
| 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 |
| 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 | 10 MHz  64QAM 1/2 | R.34 TDD (Note 1) | OP.1 TDD | EPA5 | 2x2 Low | 70 | 22.0 | ≥2 |
| 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 | Test 3 |
| Downlink power allocation |  | dB | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | |
| CSI reference signals | |  | Antenna ports 15,…,22 | Antenna ports 15,…,18 | Antenna ports 15,…,18 |
| Beamforming model | |  | Annex B.4.1 | Annex B.4.1 | Annex B.4.1 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 | 5 / 4 | 5 / 4 |
| CSI reference signal configuration | |  | 1 | 3 | 3 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 4 / 0010000100000000 | 4 / 0010000000000000 | 4/  0010000000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | 50 | 100 |
| Simultaneous transmission | |  | No | Yes (Note 3, 5) | No |
| PDSCH transmission mode | |  | 9 | 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 | UE DL Cat-egory |
| 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 | ≥6 |
| 3 | 20MHz  256QAM | R. 66 TDD | OP.1 TDD | EPA5 | 2x2 Low | 70 | 24.3 | 11-12 | ≥11 |

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 |
| Note 1: The reference channel applies to both the input signal under test and the interfering signal. | | | | | | | | |

#### 8.3.2.1B Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.2.1B-2, with the addition of the parameters in Table 8.3.2.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.2.1B-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1and Cell 2, respectively.

Table 8.3.2.1B-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports 15,…,18 | N/A |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 | N/A |
| CSI reference signal configuration | |  | 0 | N/A |
| at antenna port | | dBm/15kHz | -98 | N/A |
| DIP (Note 2) | | dB | N/A | -1.73 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 126 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 9 | N/A |
| Beamforming model | |  | As specified in clause B.4.3  (Note 4, 5) | N/A |
| Interference model | |  | N/A | As specified in clause B.5.4 |
| Probability of occurrence of transmission rank in interfering cells | Rank 1 |  | N/A | 70 |
| Rank 2 |  | N/A | 30 |
| Precoder update granularity | | PRB | 50 | 6 |
| PMI delay (Note 5) | | ms | 10 or 11 | N/A |
| Reporting interval | | ms | 5 | N/A |
| Reporting mode | |  | PUCCH 1-1 | N/A |
| CodeBookSubsetRestriction bitmap | |  | 0000000000000000000000000000000000000000000000001111111111111111 | N/A |
| Symbols for unused PRBs | |  | OCNG (Note 6) | N/A |
| Simultaneous transmission | |  | No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test | N/A |
| Physical channel for CQI reporting | |  | PUSCH(Note 8) | N/A |
| cqi-pmi-ConfigurationIndex | |  | 4 | N/A |
| Note 1:  Note 2: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.  Note 4: The precoder in clause B.4.3 follows UE recommended PMI.  Note 5: 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 6: 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 7: All cells are time-synchronous.  Note 8: 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#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3. | | | | |

Table 8.3.2.1B-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Reference Channel | | OCNG Pattern | | | | Propagation Conditions | | | | Correlation Matrix and Antenna Configuration (Note 3) | | Reference Value | | | | UE Category | |
| Cell 1 | | Cell 2 | | Cell 1 | | Cell 2 | | Fraction of Maximum Throughput (%) | | SINR (dB) (Note 2) | |
| 1 | R.48 TDD | | OP.1 TDD | | N/A | | EVA5 | | EVA5 | | 4x2 Low | | 70 | | -1.0 | | ≥1 | |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2. | | | | | | | | | | | | | | | | | | |

#### 8.3.2.1C Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.2.1C-2, with the addition of parameters in Table 8.3.2.1C-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.2.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.2.1C-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | | |
| Uplink downlink Configuration | | |  | | 1 | | 1 | | 1 | | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | | |
| Downlink power allocation | |  | dB | | 0 | | -3 | | -3 | | |
|  | dB | | 0 (Note 1) | | -3 (Note 1) | | -3 (Note 1) | | |
| σ | dB | | -3 | | N/A | | N/A | | |
| at antenna port | |  | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A | | |
|  | dBm/15kHz | | -98 (Note 3) | | N/A | | N/A | | |
|  | dBm/15kHz | | -93 (Note 4) | | N/A | | N/A | | |
|  | | | dB | | Reference Value in Table 8.3.2.1C-2 | | 12 | | 10 | | |
| BWChannel | | | MHz | | 10 | | 10 | | 10 | | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | | |
| Cell Id | | |  | | 0 | | 1 | | 126 | | |
| Cell-specific reference signals | | |  | | Antenna ports 0,1 | | | | | | |
| CSI reference signals | | |  | | Antenna ports 15,16 | | N/A | | N/A | | |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | | 5 / 4 | | N/A | | N/A | | |
| CSI reference signal configuration | | |  | | 8 | | N/A | | N/A | | |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | | 4 /  0010000000000000 | | N/A | | N/A | | |
| ABS pattern (Note 5) | | |  | | N/A | | 0000000001  0000000001 | | 0000000001  0000000001 | | |
| RLM/RRM Measurement Subframe Pattern (Note 6) | | |  | | 0000000001  0000000001 | | N/A | | N/A | | |
| CSI Subframe Sets (Note7) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | | N/A | | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | | N/A | | |
| Number of control OFDM symbols | | |  | | 2 | | Note 8 | | Note 8 | | |
| PDSCH transmission mode | | |  | | TM9-1layer | | Note 9 | | Note 9 | | |
| Precoding granularity | | |  | | Frequency domain: 1 PRG  Time domain: 1 ms | | N/A | | N/A | | |
| Beamforming model | | |  | | Annex B.4.1 | | N/A | | N/A | | |
| Cyclic prefix | | |  | | Normal | | 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]. 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 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.  Note 10: 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 11: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.  Note 12: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.  Note 14: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8. | | | | | | | | | | |

Table 8.3.2.1C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note1) | | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.51 TDD | OP.1TDD | OP.1TDD | OP.1TDD | EVA5 | | | 2x2 Low | 70 | 8.5 | ≥2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | |

#### 8.3.2.1D Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9 interference

The requirements are specified in Table 8.3.2.1D-2, with the addition of the parameters in Table 8.3.2.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.2.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (NOTE 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | 3 | 3 |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | 2 | 2 |
| PDSCH transmission mode | | |  | 9 | 9 | 9 |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.4 | As specified in clause B.6.4 |
| CSI reference signals | | |  | Antenna ports 15, 16, 17, 18 | Antenna ports 15, 16 | Antenna ports 15, 16 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | 10 / 4 | 10 / 4 | 10 / 4 |
| CSI reference signal configuration | | |  | 5 | 6 | 7 |
| Zero-power CSI-RS configuration  *I*CSI-RS /*ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | 9 /  1000000000000000 | 9 /  0100000000000000 | 9 /  0010000000000000 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.2.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration | | | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.69 TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 4x2 Low | 2x2 Low | 2x2 Low | 85 | 18.0 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | | | | | | | | | | | |

#### 8.3.2.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.2.1E-2, with the addition of the parameters in Table 8.3.2.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.2.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (NOTE 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | 3 | 3 |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | 2 | 2 |
| PDSCH transmission mode | | |  | 8 | N/A | N/A |
| Interference model | | |  | N/A | As specified in clause B.6.5 | As specified in clause B.6.5 |
| Precoding | | |  | Random wideband precoding per TTI | N/A | N/A |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 3) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.2.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.71 TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 14.0 | ≥2 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 8.3.2.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference

The requirements are specified in Table 8.3.2.1F-2, with the addition of the parameters in Table 8.3.2.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.2.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | 0 | -3 | -3 |
|  | dB | 0 (NOTE 1) | -3 | -3 |
| σ | dB | -3 | 0 | 0 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 3.28 | 0.74 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | Random from set {1,2,3} | Random from set {1,2,3} |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | Random from set {1,2} | Random from set {1,2} |
| PDSCH transmission mode | | |  | 8 | 3 | 3 |
| Interference model | | |  | N/A | As specified in clause B.6.2 | As specified in clause B.6.2 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.2 | As specified in clause B.6.2 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (NOTE 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| NOTE 1:  NOTE 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  NOTE 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  NOTE 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.2.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration (NOTE 3) | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (NOTE 2) |
| 1 | R.70 TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 2x2 Low | 85 | 11.3 | ≥1 |
| NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  NOTE 2: SNR corresponds to  of Cell 1 as defined in clause 8.1.1.  NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | | | | | |

#### 8.3.2.1G Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.2.1G-2, with the addition of the parameters in Table 8.3.2.1G-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.2.1G-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1G-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) Multiplexing with TM10 serving cell configuration and TM9 interference model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink Configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | |  | dB | 0 | 0 | 0 |
|  | dB | 0 (Note 1) | 0 | 0 |
| σ | dB | -3 | -3 | -3 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| at antenna port | | | dBm/15kHz | -98 | | |
|  | | | dB | N/A | 13.91 | 3.34 |
| BWChannel | | | MHz | 10 | 10 | 10 |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell Id | | |  | 0 | 1 | 6 |
| Number of control OFDM symbols in normal subframes | | |  | 3 | 3 | 3 |
| CFI indicated in PCFICH in normal subframes | | |  | 3 | 3 | 3 |
| Number of control OFDM symbols in special subframes | | |  | 2 | 2 | 2 |
| CFI indicated in PCFICH in special subframes | | |  | 2 | 2 | 2 |
| PDSCH transmission mode | | |  | 10 | 9 | 9 |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Precoding | | |  | Random wideband precoding per TTI | As specified in clause B.6.4 | As specified in clause B.6.4 |
| CSI reference signals | | |  | Antenna ports 15, 16, 17, 18 | Antenna ports 15, 16 | Antenna ports 15, 16 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | | Subframes | 10 / 4 | 10 / 4 | 10 / 4 |
| CSI reference signal configuration | | |  | 5 | 6 | 7 |
| Zero-power CSI-RS configuration  *I*CSI-RS /*ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | 9 /  1000000000000000 | 9 /  0100000000000000 | 9 /  0010000000000000 |
| Time offset to cell 1 | | | us | N/A | 2 | 3 |
| Frequency offset to cell 1 | | | Hz | N/A | 200 | 300 |
| MBSFN | | |  | Not configured | Not configured | Not configured |
| NeighCellsInfo-r12  (Note 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| Note 1:  Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.  Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.  Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 8.3.2.1G-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS Multiplexing with TM10 serving cell configuration and TM9 interference model

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions | | | Correlation Matrix and Antenna Configuration | | | Reference Value | | UE Category |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 2) |
| 1 | R.69 TDD | OP.1 TDD | N/A | N/A | EPA5 | EPA5 | EPA5 | 4x2 Low | 2x2 Low | 2x2 Low | 85 | 18.0 | ≥1 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: SINR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | | | | | | | | | | | |

#### 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 |
| 2 | 10 MHz  16QAM 1/2 | R.32 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 21.7 | ≥2 |

#### 8.3.2.2A Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing

The requirements are specified in Table 8.3.2.2A-2, with the addition of the parameters in Table 8.3.2.2A-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 upon antenna ports 7 and 8.

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

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | -3 |
| Cell-specific reference symbols | |  | Antenna port 0 and antenna port 1 |
| Beamforming model | |  | Annex B.4.2 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG  (Note 2) |
| Number of allocated resource blocks | | PRB | 50 |
| PDSCH transmission mode | |  | 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 8.3.2.2A-2: Enhanced Performance Requirement Type C 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  16QAM 1/2 | R.32 TDD | OP.1 TDD | EPA5 | 2x2 Medium | 70 | 17.0 | ≥2 |

#### 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 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

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 | |
| Cell 1 | Cell 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| PDSCH\_RA | dB | 4 | N/A |
| PDSCH\_RB | dB | 4 | N/A |
| Cell-specific reference signals | |  | Antenna ports 0 and 1 | Antenna ports 0 and 1 |
| Cell ID | |  | 0 | 126 |
| CSI reference signals | |  | Antenna ports 15,16 | NA |
| Beamforming model | |  | Annex B.4.2 | NA |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 | NA |
| CSI reference signal configuration | |  | 8 | NA |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 4 /  0010000000000000 | NA |
| at antenna port | | dBm/15kHz | -98 | -98 |
|  | |  | Reference Value in Table 8.3.2.3-2 | Test specific,  7.25dB |
| Symbols for unused PRBs | |  | OCNG (Note 2) | NA |
| Number of allocated resource blocks (Note 2) | | PRB | 50 | NA |
| Simultaneous transmission | |  | No | NA |
| PDSCH transmission mode | |  | 9 | Blanked |
| 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** | |
| **Cell 1** | | **Cell 2** | | **Cell 1** | | **Cell 2** | | **Fraction of Maximum**  **Throughput (%)** | | **SNR (dB)** | |
| 1 | | 10 MHz  16QAM 1/2 | | R.51 TDD | | OP.1 TDD | | N/A | | ETU5 | | ETU5 | | 2x2 Low | | 70 | | 14.8 | | ≥2 |
| Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.  Note 3: SNR corresponds to  of Cell 1. | | | | | | | | | | | | | | | | | | | | |

#### 8.3.2.4 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

##### 8.3.2.4.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.1-3, with the additional parameters in Table 8.3.2.4.1-1 and Table 8.3.2.4.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ (PQI) signalling defined in [6], configured according to Table 8.3.2.4.1-2. In Tables 8.3.2.4.1-1 and 8.3.2.4.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.1-1: Test Parameters for quasi co-location type B: same Cell ID

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | (Note 2) |
| CSI-RS 0 antenna ports | |  | NA | Port {15,16} |
| *qcl-CSI-RS-ConfigNZPId-r11,* CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | NA | 5/4 |
| *qcl-CSI-RS-ConfigNZPId-r11,* CSI-RS 0 configuration | |  | NA | 8 |
| *csi-RS-ConfigZPId-r11,* Zero-power CSI-RS 0 configuration *I*CSI-RS / *ZeroPower CSI-RS* bitmap | |  | NA | 4/  0000010000000000 |
| at antenna port | | dBm/15kHz | -98 | -98 |
|  | | dB | Reference point in Table 8.3.2.4.1-3 | Reference point in Table 8.3.2.4.1-3 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 0 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | Blanked | 10 |
| Number of allocated PRB | | PRB | NA | 50 |
| *qcl-Operation, ‘*PDSCH RE Mapping and Quasi-Co-Location Indicator’ | |  | Type B, ‘00’ | |
| Time offset between TPs | | μs | NA | Reference point in Table 8.3.2.4.1-3 |
| Frequency error between TPs | | Hz | NA | 0 |
| Beamforming model | |  | NA | Port 7 as specified in clause B.4.1 |
| Symbols for unused PRBs | |  | NA | OCNG (Note 3) |
| Note 1:  Noet 2: REs for antenna ports 0 and 1 have zero transmission power.  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, which is QPSK modulated. | | | | |

Table 8.3.2.4.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PQI set index | Parameters in each PQI set | | DL transmission hypothesis for each PQI Set | |
| NZP CSI-RS Index (For quasi co-location) | ZP CSI-RS configuration | TP 1 | TP 2 |
| PQI set 0 | CSI-RS 0 | ZP CSI-RS 0 | Blanked | PDSCH |

Table 8.3.2.4.1-3: Minimum performance for quasi co-location type B: same Cell ID

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OGCN pattern | | Time offset between TPs (μs) | Propagation Conditions (Note1) | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.52 TDD | NA | OP.1 TDD | 2 | EPA5 | EPA5 | 2x2 Low | 70 | 12 | ≥2 |
| 2 | R.52 TDD | NA | OP.1 TDD | -0.5 | EPA5 | EPA5 | 2x2 Low | 70 | 12.4 | ≥2 |
| Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.  Note 3: SNR corresponds to of TP 2 as defined in clause 8.1.1. | | | | | | | | | | |

##### 8.3.2.4.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.2.4.2-3, with the additional parameters in Tables 8.3.2.4.2-1 and 8.3.2.4.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ (PQI) signalling defined in [6]. In Tables 8.3.2.4.2-1 and 8.3.2.4.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.2-1: Test Parameters for timing offset compensation with DPS transmission

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Beamforming model | |  | As specified in clause B.4.1 | As specified in clause B.4.1 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | (Note 2) |
| CSI reference signals 0 | |  | Antenna ports {15,16} | N/A |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 | N/A |
| CSI reference signal 0 configuration | |  | 0 | N/A |
| CSI reference signals 1 | |  | N/A | Antenna ports {15,16} |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | N/A | 5 / 4 |
| CSI reference signal 1 configuration | |  | N/A | 8 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmap | | Subframes/bitmap | 4/  0010000000000000 | N/A |
| Zero-power CSI-RS1 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmapS | | Subframes/bitmap | N/A | 4/  0000010000000000 |
|  | | dB | Reference Value in Table 8.3.2.4.2-3 | Reference Value in Table 8.3.2.4.2-3 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 0 |
| Number of control OFDM symbols | |  | 2 | 2 |
| Timing offset between TPs | |  | N/A | Reference Value in Table 8.3.2.4.2-3 |
| Frequency offset between TPs | | Hz | N/A | 0 |
| Number of allocated resource blocks | | PRB | 50 | 50 |
| PDSCH transmission mode | |  | 10 | 10 |
| Probability of occurrence of PDSCH transmission(Note 3) | | % | 30 | 70 |
| Symbols for unused PRBs | |  | OCNG (Note 4) | OCNG (Note 4) |
| Note 1:  Note 2: REs for antenna ports 0 and 1 have zero transmission power.  Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.  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. | | | | |

Table 8.3.2.4.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PQI set index | Parameters in each PQI set | | DL transmission hypothesis for each PQI Set | |
| NZP CSI-RS Index (For quasi co-location) | ZP CSI-RS configuration | TP 1 | TP 2 |
| PQI set 0 | CSI-RS 0 | ZP CSI-RS 0 | PDSCH | Blanked |
| PQI set 1 | CSI-RS 1 | ZP CSI-RS 1 | Blanked | PDSCH |

Table 8.3.2.4.2-3: Performance Requirements for timing offset compensation with DPS transmission

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Timing offset(us) | Reference Channel | OCNG Pattern | | Propagation Conditions | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
|  | TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | 2 | R.53 TDD | OP.1 TDD | OP.1 TDD | EPA5 | EPA5 | 2x2 Low | 70 | 12.3 | ≥2 |
| 2 | -0.5 | R.53 TDD | OP.1 TDD | OP.1 TDD | EPA5 | EPA5 | 2x2 Low | 70 | 12.5 | ≥2 |
| Note 1: The propagation conditions for TP 1and TP 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.  Note 3: SNR corresponds to  of both TP 1 and TP 2 as defined in clause 8.1.1. | | | | | | | | | | |

##### 8.3.2.4.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.3-2, with the additional parameters in Table 8.3.2.4.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the ‘PDSCH RE Mapping and Quasi-Co-Location Indicator’ signalling defined in [6]. In Table 8.3.2.4.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| parameter | | Unit | TP 1 | TP 2 |
| Downlink power allocation |  | dB | 0 | 0 |
|  | dB | 0 (Note 1) | 0 |
| σ | dB | -3 | -3 |
| Beamforming model | |  | N/A | As specified in clause B.4.2 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| CSI reference signals 0 | |  | N/A | Antenna ports {15,16} |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | N/A | 5 / 4 |
| CSI reference signal 0 configuration | |  | N/A | 0 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPower CSI-RS* bitmap | | Subframes/bitmap | N/A | 4/  0010000000000000 |
|  | | dB | Reference point in Table 8.3.2.4.3-2 + 4dB | Reference Value in Table 8.3.2.4.3-2 |
| at antenna port | | dBm/15kHz | -98 | -98 |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Cell Id | |  | 0 | 126 |
| Number of control OFDM symbols | |  | 1 | 2 |
| Timing offset between TPs | | us | N/A | 0 |
| Frequency offset between TPs | | Hz | N/A | 200 |
| *qcl-Operation, ‘*PDSCH RE Mapping and Quasi-Co-Location Indicator’ | |  | Type B, ‘00’ | |
| PDSCH transmission mode | |  | Blank | 10 |
| Number of allocated resource block | |  | N/A | 50 |
| Symbols for unused PRBs | |  | N/A | OCNG(Note2) |
| 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 8.3.2.4.3-2: Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Reference Channel | OCNG Pattern | | Propagation Conditions (Note1) | | Correlation Matrix and Antenna Configuration (Note 2) | Reference Value | | UE Category |
| TP 1 | TP 2 | TP 1 | TP 2 | Fraction of Maximum Throughput (%) | SNR (dB) (Note 3) |
| 1 | R.54 TDD | | N/A | OP.1TDD | EPA5 | ETU5 | 2x2 Low | 70 | 14.7 | ≥2 |
| Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.  Note 3: SNR corresponds to  of TP 2 as defined in clause 8.1.1. | | | | | | | | | | |

## 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. 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. | | | | | | | | | |

##### 8.4.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-4.

In Tables 8.4.1.2.4-1 and 8.4.1.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.1.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | -3 | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | -3 | -3 | -3 |
| at antenna port |  | dBm/15kHz | -98(Note 1) | N/A | N/A |
|  | dBm/15kHz | -98 (Note 2) | N/A | N/A |
|  | dBm/15kHz | -93 (Note 3) | N/A | N/A |
|  | | dB | Reference Value in Table 8.4.1.2.4-2 | 5 | 3 |
| BWChannel | | MHz | 10 | 10 | 10 |
| Subframe Configuration | |  | Non-MBSFN | Non-MBSFN | Non-MBSFN |
| Time Offset between Cells | | μs | N/A | 3 | -1 |
| Frequency shift between Cells | | Hz | N/A | 300 | -100 |
| Cell Id | |  | 0 | 126 | 1 |
| ABS pattern (Note 4) | |  | N/A | 00000100  00000100  00000100  00000100  00000100 | 00000100  00000100  00000100  00000100  00000100 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | |  | 00000100 00000100 00000100 00000100 00000100 | N/A | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 |  | 00000100 00000100 00000100 00000100 00000100 | N/A | N/A |
| CCSI,1 |  | 11111011 11111011 11111011 11111011 11111011 | N/A | N/A |
| Number of control OFDM symbols | |  | 2 | Note 7 | Note 7 |
| PHICH Ng (Note 10) | |  | 1 | N/A | N/A |
| PHICH duration | |  | Normal | N/A | N/A |
| Unused RE-s and PRB-s | |  | OCNG | OCNG | OCNG |
| Cyclic prefix | |  | Normal | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 8: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.  Note 9: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.  Note 10 According to Clause 6.9 in TS 36.211 [4] | | | | | |

Table 8.4.1.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Aggregation Level | | Reference Channel | | OCNG Pattern | | | | | | Propagation Conditions (Note 1) | | | | | | Correlation Matrix and Antenna Configuration (Note 2) | | Reference Value | | | |
| Cell 1 | | Cell 2 | | Cell 3 | | Cell 1 | | Cell 2 | | Cell3 | | Pm-dsg (%) | | SNR (dB) (Note 3) | |
| 1 | | 8 CCE | | R.15-2 FDD | | OP.1 FDD | | OP.1 FDD | | OP.1 FDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 1 | | -2.2 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | | | | | | | | | | | | | |

Table 8.4.1.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | | Cell 3 | |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | -3 | | -3 | | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | -3 | | -3 | | -3 |
| at antenna port |  | dBm/15kHz | -98(Note 1) | | N/A | | N/A |
|  | dBm/15kHz | -98 (Note 2) | | N/A | | N/A |
|  | dBm/15kHz | -93 (Note 3) | | N/A | | N/A |
|  | | dB | Reference Value in Table 8.4.1.2.4-4 | | 5 | | 3 |
| BWChannel | | MHz | 10 | | 10 | | 10 |
| Subframe Configuration | |  | Non-MBSFN | | MBSFN | | MBSFN |
| Time Offset between Cells | | μs | N/A | | 3 | | -1 |
| Frequency shift between Cells | | Hz | N/A | | 300 | | -100 |
| Cell Id | |  | 0 | | 126 | | 1 |
| ABS pattern (Note 4) | |  | N/A | | 0001000000  0100000010  0000001000  0000000000 | | 0001000000  0100000010  0000001000  0000000000 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | |  | 0001000000 0100000010 0000001000 0000000000 | | N/A | | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 |  | 0001000000 0100000010 0000001000 0000000000 | | N/A | | N/A |
| CCSI,1 |  | 1110111111 1011111101 1111110111 1111111111 | | N/A | | N/A |
| MBSFN Subframe Allocation (Note 7) | |  | N/A | | 001000  100001  000100  000000 | | 001000  100001  000100  000000 |
| Number of control OFDM symbols | |  | 2 | | Note 8 | | Note 8 |
| PHICH Ng (Note 12) | |  | 1 | | N/A | | N/A |
| PHICH duration | |  | Normal | | N/A | | N/A |
| Unused RE-s and PRB-s | |  | OCNG | | OCNG | | OCNG |
| Cyclic prefix | |  | Normal | | 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: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits are chosen for MBSFN subframe allocation.  Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: 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 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.  Note 12: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | |

Table 8.4.1.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Aggregation Level | | Reference Channel | | OCNG Pattern | | | | | | Propagation Conditions (Note 1) | | | | | | Correlation Matrix and Antenna Configuration (Note 2) | | Reference Value | | | |
| Cell 1 | | Cell 2 | | Cell 3 | | Cell 1 | | Cell 2 | | Cell3 | | Pm-dsg (%) | | SNR (dB) (Note 3) | |
| 1 | | 8 CCE | | R.15-2 FDD | | OP.1 FDD | | OP.1 FDD | | OP.1 FDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 1 | | -2.0 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | | | | | | | | | | | | | |

### 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. 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. | | | | | | | | | |

##### 8.4.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-4.

In Tables 8.4.2.2.4-1 and 8.4.2.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell 3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.2.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | | -3 |
| at antenna port |  | | dBm/15kHz | | -98(Note 1) | | N/A | | N/A |
|  | | dBm/15kHz | | -98 (Note 2) | | N/A | | N/A |
|  | | dBm/15kHz | | -93 (Note 3) | | N/A | | N/A |
|  | | | dB | | Reference Value in Table 8.4.2.2.4-2 | | 5 | | 3 |
| BWChannel | | | MHz | | 10 | | 10 | | 10 |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 |
| Cell Id | | |  | | 0 | | 126 | | 1 |
| ABS pattern (Note 4) | | |  | | N/A | | 0000000001  0000000001 | | 0000000001  0000000001 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | | |  | | 0000000001 0000000001 | | N/A | | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 | |  | | 0000000001 0000000001 | | N/A | | N/A |
| CCSI,1 | |  | | 1100111000 1100111000 | | N/A | | N/A |
| Number of control OFDM symbols | | |  | | 2 | | Note 7 | | Note 7 |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A |
| PHICH Ng (Note 10) | | |  | | 1 | | N/A | | N/A |
| PHICH duration | | |  | | Normal | | N/A | | N/A |
| Unused RE-s and PRB-s | | |  | | OCNG | | OCNG | | OCNG |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 8: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.  Note 9: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.  Note 10: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | | | |

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Aggregation Level | | Reference Channel | | OCNG Pattern | | | | | | Propagation Conditions (Note 1) | | | | | | Correlation Matrix and Antenna Configuration (Note 2) | | Reference Value | | | |
| Cell 1 | | Cell 2 | | Cell 3 | | Cell 1 | | Cell 2 | | Cell3 | | Pm-dsg (%) | | SNR (dB) (Note 3) | |
| 1 | | 8 CCE | | R.15-2 TDD | | OP.1 TDD | | OP.1 TDD | | OP.1 TDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 1 | | -2.0 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | | | | | | | | | | | | | |

Table 8.4.2.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Uplink downlink configuration | | |  | 1 | 1 | 1 |
| Special subframe configuration | | |  | 4 | 4 | 4 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | -3 | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | -3 | -3 | -3 |
| at antenna port |  | dBm/15kHz | -98 (Note 1) | N/A | N/A |
|  | dBm/15kHz | -98 (Note 2) | N/A | N/A |
|  | dBm/15kHz | -93 (Note 3) | N/A | N/A |
|  | | dB | Reference Value in Table 8.4.2.2.4-4 | 5 | 3 |
| BWChannel | | MHz | 10 | 10 | 10 |
| Subframe Configuration | |  | Non-MBSFN | MBSFN | MBSFN |
| Time Offset between Cells | | μs | N/A | 3 | -1 |
| Frequency shift between Cells | | Hz | N/A | 300 | -100 |
| Cell Id | |  | 0 | 126 | 1 |
| ABS pattern (Note 4) | |  | N/A | 0000000001  0000000001 | 0000000001  0000000001 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | |  | 0000000001 0000000001 | N/A | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 |  | 0000000001 0000000001 | N/A | N/A |
| CCSI,1 |  | 1100111000 1100111000 | N/A | N/A |
| MBSFN Subframe Allocation (Note 7) | |  | N/A | 000010 | 000010 |
| Number of control OFDM symbols | |  | 2 | Note 8 | Note 8 |
| ACK/NACK feedback mode | |  | Multiplexing | N/A | N/A |
| PHICH Ng (Note 11) | |  | 1 | N/A | N/A |
| PHICH duration | |  | Normal | N/A | N/A |
| Unused RE-s and PRB-s | |  | OCNG | OCNG | OCNG |
| Cyclic prefix | |  | Normal | 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: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.  Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 9: 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 10: SIB-1 will not be transmitted in Cell2 in this test.  Note 11: According to Clause 6.9 in TS 36.211 [4]. | | | | | |

Table 8.4.2.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | | Aggregation Level | | Reference Channel | | OCNG Pattern | | | | | | Propagation Conditions (Note 1) | | | | | | Correlation Matrix and Antenna Configuration (Note 2) | | Reference Value | | | |
| Cell 1 | | Cell 2 | | Cell 3 | | Cell 1 | | Cell 2 | | Cell3 | | Pm-dsg (%) | | SNR (dB) (Note 3) | |
| 1 | | 8 CCE | | R.15-2 TDD | | OP.1 TDD | | OP.1 TDD | | OP.1 TDD | | EVA5 | | EVA5 | | EVA5 | | 2x2 Low | | 1 | | -1.8 | |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | | | | | | | | | | | | | | | | | |

## 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 |
| 1A | 5MHz (Note 1) | R.19-1 | OP.1 FDD | EVA 70 | 2x2 Low | 0.1 | 4 |
| Note 1: Test case applicability is defined in 8.1.2.1. | | | | | | | |

##### 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. | | | | | | | | |

##### 8.5.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.4-2. In Table 8.5.1.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.1.2.4-1: Test Parameters for PHICH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | dB | -3 | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | dB | -3 | -3 | -3 |
| at antenna port |  | dBm/15kHz | -98 (Note 1) | N/A | N/A |
|  | dBm/15kHz | -98 (Note 2) | N/A | N/A |
|  | dBm/15kHz | -93 (Note 3) | N/A | N/A |
|  | | dB | Reference Value in Table 8.5.1.2.4-2 | 5 | 3 |
| BWChannel | | MHz | 10 | 10 | 10 |
| Subframe Configuration | |  | Non-MBSFN | Non-MBSFN | Non-MBSFN |
| Time Offset between Cells | | μs | N/A | 3 | -1 |
| Frequency shift between Cells | | Hz | N/A | 300 | -100 |
| Cell Id | |  | 0 | 126 | 1 |
| PDCCH Content | |  | UL Grant should be included with the proper information aligned with A.3.6. | N/A | N/A |
| ABS pattern (Note 4) | |  | N/A | 00000100  00000100  00000100  00000100  00000100 | 00000100  00000100  00000100  00000100  00000100 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | |  | 00000100  00000100  00000100  00000100  00000100 | N/A | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 |  | 00000100  00000100  00000100  00000100  00000100 | N/A | N/A |
| CCSI,1 |  | 11111011  11111011  11111011  11111011  11111011 | N/A | N/A |
| Number of control OFDM symbols | |  | 2 | Note 7 | Note 7 |
| PHICH Ng (Note 10) | |  | 1 | N/A | N/A |
| PHICH duration | |  | Normal | N/A | N/A |
| Unused RE-s and PRB-s | |  | OCNG | OCNG | OCNG |
| Cyclic prefix | |  | Normal | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 8: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 9: SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.  Note 10: According to Clause 6.9 in TS 36.211 [4]. | | | | | |

Table 8.5.1.2.4-2: Minimum performance PHICH

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note 1) | | | Antenna Configuration and Correlation Matrix (Note 2) | Reference Value | |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Pm-an (%) | SNR (dB) (Note 3) |
| 1 | R.19 | OP.1 FDD | OP.1 FDD | OP.1 FDD | EPA5 | EVA5 | EVA5 | 2x2 Low | 0.1 | 5.0 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of Cell 1. | | | | | | | | | | |

### 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. | | | | | | | | |

##### 8.5.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.4-2. In Table 8.5.2.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.2.2.4-1: Test Parameters for PHICH

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 |
| Downlink power allocation | PDCCH\_RA  PHICH\_RA  OCNG\_RA | | dB | | -3 | | -3 | -3 |
| PCFICH\_RB  PDCCH\_RB  PHICH\_RB  OCNG\_RB | | dB | | -3 | | -3 | -3 |
| at antenna port |  | | dBm/15kHz | | -98 (Note 1) | | N/A | N/A |
|  | | dBm/15kHz | | -98 (Note 2) | | N/A | N/A |
|  | | dBm/15kHz | | -93 (Note 3) | | N/A | N/A |
|  | | | dB | | Reference Value in Table 8.5.2.2.4-2 | | 5 | 3 |
| BWChannel | | | MHz | | 10 | | 10 | 10 |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | Non-MBSFN |
| Time Offset between Cells | | | μs | | N/A | | 3 | -1 |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | -100 |
| Cell Id | | |  | | 0 | | 126 | 1 |
| PDCCH Content | | |  | | UL Grant should be included with the proper information aligned with A.3.6. | | N/A | N/A |
| ABS pattern (Note 4) | | |  | | N/A | | 0000000001  0000000001 | 0000000001  0000000001 |
| RLM/RRM Measurement Subframe Pattern (Note 5) | | |  | | 0000000001 0000000001 | | N/A | N/A |
| CSI Subframe Sets (Note 6) | CCSI,0 | |  | | 0000000001 0000000001 | | N/A | N/A |
| CCSI,1 | |  | | 1100111000 1100111000 | | N/A | N/A |
| Number of control OFDM symbols | | |  | | 2 | | Note 7 | Note 7 |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | N/A |
| PHICH Ng (Note 10) | | |  | | 1 | | N/A | N/A |
| PHICH duration | | |  | | Normal | | N/A | N/A |
| Unused RE-s and PRB-s | | |  | | OCNG | | OCNG | OCNG |
| Cyclic prefix | | |  | | Normal | | 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: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by “0” of ABS pattern.  Note 8: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  Note 9: SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.  Note 10: According to Clause 6.9 in TS 36.211 [4]. | | | | | | | | |

Table 8.5.2.2.4-2: Minimum performance PHICH

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | OCNG Pattern | | | Propagation Conditions (Note 1) | | | Antenna Configuration and Correlation Matrix (Note 2) | Reference Value | |
| Cell 1 | Cell 2 | Cell 3 | Cell 1 | Cell 2 | Cell 3 | Pm-an (%) | SNR (dB) (Note 3) |
| 1 | R.19 | OP.1 TDD | OP.1 TDD | OP.1 TDD | EPA5 | EVA5 | EVA5 | 2x2 Low | 0.1 | 5.7 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of Cell 1. | | | | | | | | | | |

## 8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as



Where A is the number of correctly decoded MIB PDUs and B is the Number of transmitted MIB PDUs (Redundancy versions for the same MIB are not counted separately).

### 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 |

##### 8.6.1.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.1.2.3-1 and Table 8.6.1.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, repectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.1.2.3-1: Test Parameters for PBCH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | PBCH\_RA  OCNG\_RA | dB | -3 | -3 | -3 |
| PBCH\_RB  OCNG\_RB | dB | -3 | -3 | -3 |
| at antenna port | | dBm/15kHz | -98 | N/A | N/A |
|  | | dB | Reference Value in Table 8.6.1.2.3-2 | 4 | 2 |
| BWChannel | | MHz | 1.4 | 1.4 | 1.4 |
| Time Offset between Cells | | μs | N/A | 3 | -1 |
| Frequency shift between Cells | | Hz | N/A | 300 | -100 |
| Cell Id | |  | 0 | 126 | 1 |
| ABS Pattern (Note 4) | |  | N/A | 01000000  01000000  01000000  01000000  01000000 | 01000000  01000000  01000000  01000000  01000000 |
| Unused RE-s and PRB-s | |  | OCNG | OCNG | OCNG |
| Cyclic prefix | |  | Normal | Normal | Normal |
| Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.  Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.  Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.  Note 4: 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. | | | | | |

Table 8.6.1.2.3-2: Minimum performance PBCH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | Propagation Conditions (Note 1) | | | Antenna Configuration and Correlation Matrix (Note 2) | Reference Value | |
| Cell 1 | Cell 2 | Cell 3 | Pm-bch (%) | SNR (dB) (Note 3) |
| 1 | R.22 | ETU30 | ETU30 | ETU30 | 2x2 Low | 1 | -3.0 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 1. | | | | | | | |

### 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 |

##### 8.6.2.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.2.2.3-1 and Table 8.6.2.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.2.2.3-1: Test Parameters for PBCH

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Downlink power allocation | PBCH\_RA  OCNG\_RA | dB | -3 | -3 | -3 |
| PBCH\_RB  OCNG\_RB | dB | -3 | -3 | -3 |
| at antenna port | | dBm/15kHz | -98 | N/A | N/A |
|  | | dB | Reference Value in Table 8.6.2.2.3-2 | 4 | 2 |
| BWChannel | | MHz | 1.4 | 1.4 | 1.4 |
| Time Offset between Cells | | μs | N/A | 3 | -1 |
| Frequency shift between Cells | | Hz | N/A | 300 | -100 |
| Cell Id | |  | 0 | 126 | 1 |
| ABS Pattern (Note 4) | |  | N/A | 0000000001  0000000001 | 0000000001  0000000001 |
| Unused RE-s and PRB-s | |  | OCNG | OCNG | OCNG |
| Cyclic prefix | |  | Normal | Normal | Normal |
| Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.  Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.  Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.  Note 4: 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. | | | | | |

Table 8.6.2.2.3-2: Minimum performance PBCH

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Reference Channel | Propagation Conditions (Note 1) | | | Antenna Configuration and Correlation Matrix (Note 2) | Reference Value | |
| Cell 1 | Cell 2 | Cell 3 | Pm-bch (%) | SNR (dB) (Note 3) |
| 1 | R.22 | ETU30 | ETU30 | ETU30 | 2x2 Low | 1 | -3.0 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.  Note 3: SNR corresponds to of cell 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.

Test case is selected according to table 8.7-1 depending on UE capability for CA and EPDCCH.

Table 8.7-1: SDR test applicability

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Single carrier UE not supporting EPDCCH | CA UE not supporting EPDCCH | Single carrier UE supporting EPDCCH | CA UE supporting EPDCCH |
| FDD | 8.7.1 | 8.7.1 | 8.7.3 | 8.7.1, 8.7.3 |
| TDD | 8.7.2 | 8.7.2 | 8.7.4 | 8.7.2, 8.7.4 |

### 8.7.1 FDD (single carrier and CA)

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 and 256QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | |  | Not configured | |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied | |

For UE not supporting 256QAM, 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 and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.1-6, with the addition of the parameters in Table 8.7.1-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-7, the TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.1-3 is not applicable.

For UE supporting 256QAM and category 9/10 and category 13, the requirements are specified in both Table 8.7.1-3 and Table 8.7.1-6, with the addition of the parameters in Table 8.7.1-2 and in Table 8.7.1-5 respectivly. The downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.1-4 and in Table 8.7.1-7 for the category 9/10 and category 13, 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 64QAM)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Bandwidth (MHz) | Transmission mode | Antenna configuration | Codebook subset restriction | Downlink power allocation (dB) | | | at antenna port (dBm/15kHz) | Symbols for unused PRBs |
|  |  | σ |
| 1 | 10 | 1 | 1 x 2 | N/A | 0 | 0 | 0 | -85 | OP.6 FDD |
| 2 | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 3,4,6 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 3A | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 3B, 4A | 2x10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 3C, 4B | 15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6A | 2x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6B | 10+15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6C | 10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6D | 15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6E | 2x15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7 | 3x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7A | 15+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7B | 10+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7C | 15+15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7D | 10+15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7E | 10+10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7F | 10+15+15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7G | 5+10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| Note 1: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK for Test 1-6E, and PUCCH format 3 is used to feedback ACK/NACK for Test 7-7G. | | | | | | | | | |

Table 8.7.1-3: Minimum requirement (FDD 64QAM)

|  |  |  |  |
| --- | --- | --- | --- |
| **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 FDD | 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 |
| 6B | 36696 (Note 2) for 10MHz CC  55056 for 15MHz CC | R.31-3A FDD for 10MHz CC  R.31-5 FDD for 15MHz CC | 85 |
| 6C | 36696 (Note 2) for 10MHz CC  75376 (Note 3) for 20MHz CC | R.31-3A FDD for 10MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 6D | 55056 for 15MHz CC  75376 (Note 3) for 20MHz CC | R.31-5 FDD for 15MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 6E | 55056 (Note 5) for two 15MHz CCs | R.31-4B FDD for two 15MHz CCs | 85 |
| 7 | 75376 (Note 3) | R.31-4 FDD | 85 |
| 7A | 55056 (Note 5) for 15MHz CC  75376 (Note 3) for 20MHz CC | R.31-5 FDD for 15MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 7B | 36696 (Note 2) for 10MHz CC  75376 (Note 3) for 20MHz CC | R.31-3A FDD for 10MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 7C | 55056 (Note 5) for 15MHz CC  75376 (Note 3) for 20MHz CC | R.31-5 FDD for 15MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 7D | 36696 (Note 2) for 10MHz CC  55056 (Note 5) for 15MHz CC  75376 (Note 3) for 20MHz CC | R.31-3A FDD for 10MHz CC  R.31-5 FDD for 15MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 7E | 36696 (Note 2) for 10MHz CC  75376 (Note 3) for 20MHz CC | R.31-3A FDD for 10MHz CC  R.31-4 FDD for 20MHz CC | 85 |
| 7F | 36696 (Note 2) for 10MHz CC  55056 (Note 5) for 15MHz CC | R.31-3A FDD for 10MHz CC  R.31-5 FDD for 15MHz CC | 85 |
| 7G | 18336 (Note 6) for 5MHz CC  36696 (Note 2) for 10MHz CC  75376 (Note 3) for 20MHz CC | R.31-6 FDD for 5MHz CC  R.31-3A FDD for 10MHz CC  R.31-4 FDD for 20MHz CC | 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.  Note 6: 15840bits for sub-frame 0. | | | |

Table 8.7.1-4: Test points for sustained data rate (FRC 64QAM)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA config | Maximum supported Bandwidth/ Bandwidth combination (MHz) | Cat. 1 | Cat. 2 | Cat. 3 | Cat. 4 | Cat. 6,7 | Cat. 9,10 | Cat. 11, 12 |
| DL Cat. 11, 12 |
| Single carrier | 10 | 1 | 2 | 3A | 3A | - | - | - |
| 15 | - | - | 3C | 4B | - | - | - |
| 20 | - | - | 3 | 4 | 6 | - | - |
| CA with 2CCs | 10+10 | - | - | 3B | 4A | 4A | 4A | - |
| 10+15 | - | - | 3B | 4A | 6B | 6B | - |
| 10+20 | - | - | 3B | 4A | 6C | 6C | - |
| 15+15 |  |  | 3B | 4A | 6E | 6E | - |
| 15+20 | - | - | 3B | 4A | 6D | 6D | - |
| 20+20 | - | - | 3B or 3 (Note 4) | 4A or 4 (Note 4) | 6A | 6A | - |
| CA with 3CCs | 3x20 | - | - | - | - | 6A | 7 | 7 |
| 15+20+20 | - | - | - | - | 6A | 7A | 7A |
| 10+20+20 | - | - | - | - | 6A | 7B | 7B |
| 15+15+20 |  |  |  |  | 6D | 7C | 7C |
| 10+15+20 | - | - | - | - | 6D | 7D | 7D |
| 10+10+20 | - | - | - | - | 7E | 7E | 7E |
| 10+15+15 | - | - | - | - | 7F | 7F | 7F |
| 5+10+20 | - | - | - | - | 7G | 7G | 7G |
| 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 selecte, i.e., Test 3 for UE category 3 and Test 4 for UE category 4. Otherwise, Test 3B applies for category 3 UE and Test 4A applies for category 4 UE.  Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. | | | | | | | | |

Table 8.7.1-5: test parameters for sustained downlink data rate (FDD 256QAM)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test** | **Bandwidth (MHz)** | **Transmission mode** | **Antenna configuration** | **Codebook subset restriction** | **Downlink power allocation (dB)** | | | **at antenna port (dBm/15kHz)** | **Symbols for unused PRBs** |
|  |  | **σ** |
| 1 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 2 | 2x10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 3 | 10+15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 4 | 10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 5 | 2x15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 6 | 15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 7 | 2x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 8 | 3x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 9 | 15+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 10 | 10+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 11 | 15+15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 12 | 10+15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 13 | 10+10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 14 | 10+15+15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| 15 | 5+10+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | OP.1 FDD |
| Note 1: For CA test cases, PUCCH format 3 is used to feedback ACK/NACK. | | | | | | | | | |

Table 8.7.1-6: Minimum requirement (FDD 256QAM)

|  |  |  |
| --- | --- | --- |
| **Test** | **Measurement channel** | **Reference value** |
| **TB success rate [%]** |
| 1 | R.68 FDD | 85 |
| 2 | R.68-2 FDD | 85 |
| 3 | R.68-2 FDD for 10MHz CC  R.68-1 FDD for 15MHz CC | 85 |
| 4 | R.68-2 FDD for 10MHz CC  R.68 FDD for 20MHz CC | 85 |
| 5 | R.68-1 FDD | 85 |
| 6 | R.68-1 FDD for 15MHz CC  R.68 FDD for 20MHz CC | 85 |
| 7 | R.68 FDD | 85 |
| 8 | R.68 FDD | 85 |
| 9 | R.68-1 FDD for 15MHz CC  R.68 FDD for 20MHz CC | 85 |
| 10 | R.68-2 FDD for 10MHz CC  R.68 FDD for 20MHz CC | 85 |
| 11 | R.68-1 FDD for 15MHz CC  R.68 FDD for 20MHz CC | 85 |
| 12 | R.68-2 FDD for 10MHz CC  R.68-1 FDD for 15MHz CC  R.68 FDD for 20MHz CC | 85 |
| 13 | R.68-2 FDD for 10MHz CC  R.68 FDD for 20MHz CC | 85 |
| 14 | R.68-2 FDD for 10MHz CC  R.68-1 FDD for 15MHz CC | 85 |
| 15 | R.68-3 FDD for 5MHz CC  R.68-2 FDD for 10MHz CC  R.68 FDD for 20MHz CC | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: 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 8.7.1-7: Test points for sustained data rate (FRC 256QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| DL Cat. 11, 12 |
| Single carrier | 20 | - | 1 |  |  |  |  |
| CA with 2CCs | 2x10 | 2 | 2 |  |  |  |  |
| 10+15 | 3 | 3 |  |  |  |  |
| 10+20 | 4 | 4 |  |  |  |  |
| 2x15 | 5 | 5 |  |  |  |  |
| 15+20 | 6 | 6 |  |  |  |  |
| 20+20 | 7 | 7 |  |  |  |  |
| CA with 3CCs | 3x20 | 8 | 7 |  |  |  |  |
| 15+20+20 | 9 | 7 |  |  |  |  |
| 10+20+20 | 10 | 7 |  |  |  |  |
| 15+15+20 | 11 | 6 |  |  |  |  |
| 10+15+20 | 12 | 6 |  |  |  |  |
| 10+10+20 | 13 | 13 |  |  |  |  |
| 10+15+15 | 14 | 14 |  |  |  |  |
| 5+10+20 | 15 | 15 |  |  |  |  |

### 8.7.2 TDD (single carrier and CA)

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 and 256QAM | | |
| Number of OFDM symbols for PDCCH per component carrier | | | | OFDM symbols | 1 | | |
| Cross carrier scheduling | | | |  | Not configured | | |
| Propagation condition | |  | | Static propagation condition  No external noise sources are applied | | | |
| Note 1: as specified in Table 4.2-1 in TS 36.211 [4]. | | | | | | | |

For UE not supporting 256QAM, 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 and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.2-6, with the addition of the parameters in Table 8.7.2-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.2-7. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.2-3 is not applicable.

For UE supporting 256QAM and category 9/10 and category 13, the requirements are specified in both Table 8.7.2-3 and Table 8.7.2-6, with the addition of the parameters in Table 8.7.2-2 and in Table 8.7.2-5 respectivly. The downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.2-4 and in Table 8.7.2-7 for the category 9/10 and category 13, 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 64QAM)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Bandwidth (MHz) | Transmission mode | Antenna configuration | Codebook subset restriction | Downlink power allocation (dB) | | | at antenna port (dBm/15kHz) | ACK/NACK feedback mode | Symbols for unused PRBs |
|  |  | σ |
| 1 | 10 | 1 | 1 x 2 | N/A | 0 | 0 | 0 | -85 | Bundling | OP.6 TDD |
| 2 | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | Bundling | OP.1 TDD |
| 3 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | Bundling | OP.1 TDD |
| 3A | 15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | Muliplexing | OP.2 TDD |
| 4,6 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | Multiplexing | OP.1 TDD |
| 6A | 2x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | -  (Note 1) | OP.1 TDD |
| 6B | 20+15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 1) | OP.1 TDD |
| 7 | 3x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 2) | OP.1 TDD |
| 7A | 15+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 2) | OP.1 TDD |
| Note 1: PUCCH format 1b with channel selection is used to feedback ACK/NACK.  Note 2: PUCCH format 3 is used to feedback ACK/NACK. | | | | | | | | | | |

Table 8.7.2-3: Minimum requirement (TDD 64QAM)

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |
| 6B | 55056/0 for 15MHz CC  75376/0 for 20MHz CC (Note 2) | R31-5 TDD for 15MHz CC  R.31-4 TDD for 20MHz CC | 85 |
| 7 | 75376/0 (Note 2) | R.31-4 TDD | 85 |
| 7A | 55056/0 for 15MHz CC  75376/0 for 20MHz CC (Note 2) | R.31-5 TDD for 15MHz CC  R.31-4 TDD for 20MHz CC | 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 64QAM)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Bandwidth/ Bandwidth combination**  **(MHz)** | **Cat. 1** | **Cat. 2** | **Cat. 3** | **Cat. 4** | **Cat. 6,7** | **Cat. 9, 10** | **Cat. 11, 12** |
| DL Cat. 11, 12 |
| Single carrier | 10 | 1 | 2 | - | - | - | - | - |
| 15 | - | - | 3A | 3A | - | - | - |
| 20 | - | - | 3 | 4 | 6 | - | - |
| CA with 2CCs | 20+20 | - | -- | 3(Note 4) | 4 (Note 4) | 6A | 6A | - |
| 15+20 | - | - | 3(Note 4) | 4 (Note 4) | 6B | 6B | - |
| CA with 3 CCs | 3x20 | - | - | - | - | 6A | 7 | 7 |
| 15+20+20 | - | - | - | - | 6A | 7A | 7A |
| 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. | | | | | | | | |

Table 8.7.2-5: test parameters for sustained downlink data rate (TDD 256QAM)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Bandwidth (MHz) | Transmission mode | Antenna configuration | Codebook subset restriction | Downlink power allocation (dB) | | | at antenna port (dBm/15kHz) | ACK/NACK feedback mode | Symbols for unused PRBs |
|  |  | σ |
| 1 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | Bundling | OP.1 TDD |
| 2 | 15+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 1) | OP.1 TDD |
| 3 | 2x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 1) | OP.1 TDD |
| 4 | 3x20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 1) | OP.1 TDD |
| 5 | 15+20+20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | -85 | (Note 1) | OP.1 TDD |
| Note 1: For CA test cases, PUCCH format 3 is used to feedback ACK/NACK. | | | | | | | | | | |

Table 8.7.2-6: Minimum requirement (TDD 256QAM)

|  |  |  |
| --- | --- | --- |
| **Test** | **Measurement channel** | **Reference value** |
| **TB success rate [%]** |
| 1 | R.68 TDD | 85 |
| 2 | R.68-1 TDD for 15MHz CC  R.68 TDD for 20MHz CC | 85 |
| 3 | R.68 TDD | 85 |
| 4 | R.68 TDD | 85 |
| 5 | R.68-1 TDD for 15MHz CC  R.68 TDD for 20MHz CC | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: 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 8.7.2-7: Test points for sustained data rate (FRC 256QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Bandwidth/ Bandwidth combination**  **(MHz)** | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| DL Cat. 11, 12 |
| Single carrier | 20 | - | 1 |  |  |  |  |
| CA with 2CCs | 15+20 | 2 | 2 |  |  |  |  |
| 2x20 | 3 | 3 |  |  |  |  |
| CA with 3 CCs | 3x20 | 4 | 3 |  |  |  |  |
| 15+20+20 | 5 | 3 |  |  |  |  |

### 8.7.3 FDD (EPDCCH scheduling)

The parameters specified in Table 8.7.3-1 are valid for all FDD tests unless otherwise stated.

Table 8.7.3-1: 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 |
| Number of EPDCCH sets |  | 1 |
| EPDCCH transmission type |  | Localized |
| Number of PRB per EPDCCH set and EPDCCH PRB pair allocation |  | 2 PRB pairs  10MHz BW: Resource blocks nPRB = 48, 49 15MHz BW: Resource blocks nPRB = 70, 71  20MHz BW: Resource blocks nPRB = 98, 99 |
| EPDCCH Starting Symbol |  | Derived from CFI (i.e. default behaviour) |
| ECCE Aggregation Level |  | 2 ECCEs |
| Number of EREGs per ECCE |  | 4 |
| EPDCCH scheduling |  | EPDCCH candidate is randomly assigned in each subframe |
| EPDCCH precoder (Note 1) |  | Fixed PMI 0 |
| EPDCCH monitoring SF pattern |  | 1111111111 0000000000  1111111111 0000000000 |
| Timing advance | μs | 100 |
| Propagation condition |  | Static propagation condition  No external noise sources are applied |
| Note 1: EPDCCH precoder parameters are defined for tests with 2 x 2 antenna configuration | | |

The requirements are specified in Table 8.7.3-3, with the addition of the parameters in Table 8.7.3-2 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 8.7.3-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.3-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (FDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Bandwidth (MHz) | Transmission mode | Antenna configuration | Codebook subset restriction | Downlink power allocation (dB) | | | | at antenna port (dBm/15kHz) | Symbols for unused PRBs |
|  |  | σ | δ |
| 1 | 10 | 1 | 1 x 2 | N/A | 0 | 0 | 0 | 0 | -85 | OP.6 FDD |
| 2 | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 FDD |
| 3,4,6 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 FDD |
| 3A | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 FDD |
| 3C, 4B | 15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 FDD |

Table 8.7.3-3: 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.31E-1 FDD | 95 |
| 2 | 25456 | R.31E-2 FDD | 95 |
| 3 | 51024 | R.31E-3 FDD | 95 |
| 3A | 36696 (Note 2) | R.31E-3A FDD | 85 |
| 3C | 51024 | R.31E-3C FDD | 85 |
| 4 | 75376 (Note 3) | R.31E-4 FDD | 85 |
| 4B | 55056 (Note 5) | R.31E-4B FDD | 85 |
| 6 | 75376 (Note 3) | R.31E-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: 52752 bits for sub-frame 5. | | | |

Table 8.7.3-4: Test points for sustained data rate (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Bandwidth (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 |
| Note 1: The test is selected for maximum supported bandwidth. | | | | | | | |

### 8.7.4 TDD (EPDCCH scheduling)

The parameters specified in Table 8.7.4-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.4-1: 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 |
| Number of EPDCCH sets |  | 1 |
| EPDCCH transmission type |  | Localized |
| Number of PRB per EPDCCH set and EPDCCH PRB pair allocation |  | 2 PRB pairs  10MHz BW: Resource blocks nPRB = 48, 49  15MHz BW: Resource blocks nPRB = 70, 71 20MHz BW: Resource blocks nPRB = 98, 99 |
| EPDCCH Starting Symbol |  | Derived from CFI (i.e. default behaviour) |
| ECCE Aggregation Level |  | 2 ECCEs |
| Number of EREGs per ECCE |  | 4 for normal subframe and for special subframe |
| EPDCCH scheduling |  | EPDCCH candidate is randomly assigned in each subframe |
| EPDCCH precoder  (Note 2) |  | Fixed PMI 0 |
| EPDCCH monitoring SF pattern |  | UL-DL configuration 1: 1101111111 0000000000  UL-DL configuration 5: 1100111001 0000000000 |
| Timing advance | μs | 100 |
| Propagation condition |  | Static propagation condition  No external noise sources are applied |
| Note 1: As specified in Table 4.2-1 in TS 36.211 [4].  Note 2: EPDCCH precoder parameters are defined for tests with 2 x 2 antenna configuration | | |

The requirements are specified in Table 8.7.4-3, with the addition of the parameters in Table 8.7.4-2 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 inTable 8.7.4-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.4-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (TDD)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test** | **Bandwidth (MHz)** | **Transmission mode** | **Antenna configuration** | **Codebook subset restriction** | **Downlink power allocation (dB)** | | | | **at antenna port (dBm/15kHz)** | **Symbols for unused PRBs** | **ACK/NACK feedback mode** |
|  |  | **σ** | **δ** |
| 1 | 10 | 1 | 1 x 2 | N/A | 0 | 0 | 0 | 0 | -85 | OP.6 TDD | Bundling |
| 2 | 10 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 TDD | Bundling |
| 3 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 TDD | Bundling |
| 3A | 15 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.2 TDD | Multiplexing |
| 4,6 | 20 | 3 | 2 x 2 | 10 | -3 | -3 | 0 | 3 | -85 | OP.1 TDD | Multiplexing |

Table 8.7.4-3: 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 | R.31E-1 TDD | 95 |
| 2 | 25456/0 | R.31E-2 TDD | 95 |
| 3 | 51024/0 | R.31E-3 TDD | 95 |
| 3A | 51024/0 | R.31E-3A TDD | 85 |
| 4 | 75376/0 (Note 2) | R.31E-4 TDD | 85 |
| 6 | 75376/0 (Note 2) | R.31E-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 8.7.4-4: Test points for sustained data rate (FRC)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **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 |
| Note 1: The test is selected for maximum supported bandwidth. | | | | | | | |

### 8.7.5 TDD FDD CA

The parameters specified in Table 8.7.5-1 are valid for all TDD FDD CA tests unless otherwise stated.

Table 8.7.5-1: Common Test Parameters (TDD FDD CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | | Value | | |
| Uplink downlink configuration (Note 1) for TDD CC | | | |  | 1 | |
| Special subframe configuration (Note 2) for TDD CC | | | |  | 4 | |
| Downlink power allocation | |  | | dB | -3 | |
|  | | dB | -3 | |
| σ | | dB | 0 | |
| Cyclic prefix | | | |  | Normal | |
| Cell ID | | | |  | 0 | |
| Inter-TTI Distance | | | |  | 1 | |
| Maximum number of HARQ processes per component carrier | | FDD PCell | | Processes | 8 for FDD and TDD CCs | |
| TDD PCell | | Processes | 11 for FDD CC; 7 for TDD CC | |
| Maximum number of HARQ transmission | | | |  | 4 | |
| Redundancy version coding sequence | | | |  | {0,0,1,2} for 64QAM, 256QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | | |  | Not configured | |
| Propagation condition | | | |  | Static propagation condition  No external noise sources are applied | |
| Transmission mode | | | |  | TM3 | |
| Codebook subset restriction | | | |  | 10 | |
| Antenna configuration | | | |  | 2 x 2 | |
| at antenna port (dBm/15kHz) | | | |  | -85 | |
| Symbols for unused PRBs | | | |  | OP.1 FDD for FDD CC,  OP.1 TDD for TDD CC | |
| ACK/NACK feedback mode | | | |  | PUCCH format 3 | |
| Downlink HARQ-ACK timing | | FDD PCell | |  | As specified in Clause 7.3.3 in TS36.213 [6] | |
| TDD PCell | |  | As specified in Clause 7.3.4 in TS36.213 [6] | |
| 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]. | | | | | | |

#### 8.7.5.1 Minimum Requirement FDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.5.1-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with the maximum aggregated bandwidth as specified in Table 8.7.5.1-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.5.1-1 is not applicable.

The applicability of the requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.1-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | | | Number of bits of a DL-SCH transport block received within a TTI (for normal/special subframe for TDD, except for subframe #5) | | Measurement channel | | Reference value |
| Total | FDD CC | TDD CC | FDD CC | TDD CC | FDD CC | TDD CC | TB success rate [%] |
| 1 | 2x20 | 20 | 20 | 75376 | 75376/0 | R.31-4 FDD | R.31-4 TDD | 85 |
| 2 | 10+20 | 10 | 20 | 36696 | 75376/0 | R.31-3A FDD | R.31-4 TDD | 85 |
| 2A | 15+20 | 15 | 20 | 55056 | 75376/0 | R.31-5 FDD | R.31-4 TDD | 85 |
| 3 | 10+10 | 10 | 10 | 36696 | 36696/0 | R.31-3A FDD | R.31-6 TDD | 85 |
| 4 | 3x20 | 20 | 2x20 | 75376 | 75376/0 | R.31-4 FDD | R.31-4 TDD | 85 |
| 5 | 15+20+20 | 15 | 2x20 | 55056 | 75376/0 | R.31-5 FDD | R.31-4 TDD | 85 |
| 6 | 10+20+20 | 10 | 2x20 | 36696 | 75376/0 | R.31-3A FDD | R.31-4 TDD | 85 |

Table 8.7.5.1-2: Test points for sustained data rate (FRC 64QAM)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | | | **Cat. 1** | **Cat. 2** | **Cat. 3** | **Cat. 4** | **Cat. 6, 7** | **Cat. 9,10** | **Cat. 11, 12,** |
| **Total** | **FDD CC** | **TDD CC** | **DL Cat. 6,7** | **DL Cat. 9, 10** | **DL Cat. 11, 12** |
| CA with 2CCs | 2x20 | 20 | 20 | - | - | 3 | 3 | 1 | 1 | - |
| 10+20 | 10 | 20 | - | - | 3 | 3 | 2 | 2 | - |
| 15+20 | 15 | 20 | - | - | 3 | 3 | 2A | 2A | - |
| CA with 3CCs | 3x20 | 20 | 2x20 | - | - | - | - | 1 | 4 | 4 |
| 15+20+20 | 15 | 2x20 | - | - | - | - | 2A | 5 | 5 |
| 10+20+20 | 10 | 2x20 | - | - | - | - | 2 | 6 | 6 |
| Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.  Note 2: Void. | | | | | | | | | | |

Table 8.7.5.1-3: Minimum requirement (TDD FDD CA 256QAM)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | | | **Measurement channel** | | **Reference value** |
| **Total** | **FDD CC** | **TDD CC** | **FDD CC** | **TDD CC** | **TB success rate [%]** |
| 1 | 2x20 | 20 | 20 | R.68 FDD | R.68 TDD | 85 |
| 2 | 10+20 | 10 | 20 | R.68-2 FDD | R.68 TDD | 85 |
| 3 | 15+20 | 15 | 20 | R.68-1 FDD | R.68 TDD | 85 |
| 4 | 3x20 | 20 | 2x20 | R.68 FDD | R.68 TDD | 85 |
| 5 | 15+20+20 | 15 | 2x20 | R.68-1 FDD | R.68 TDD | 85 |
| 6 | 10+20+20 | 10 | 2x20 | R.68-2 FDD | R.68TDD | 85 |

Table 8.7.5.1-4: Test points for sustained data rate (FRC 256QAM)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | | | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| **Total** | **FDD CC** | **TDD CC** | **DL Cat. 11, 12** |
| CA with 2CCs | 2x20 | 20 | 20 | 1 | 1 |  |  |  |  |
| 10+20 | 10 | 20 | 2 | 2 |  |  |  |  |
| 15+20 | 15 | 20 | 3 | 3 |  |  |  |  |
| CA with 3CCs | 3x20 | 20 | 2x20 | 4 | 1 |  |  |  |  |
| 15+20+20 | 15 | 2x20 | 5 | 3 |  |  |  |  |
| 10+20+20 | 10 | 2x20 | 6 | 2 |  |  |  |  |
| Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled. | | | | | | | | | |

#### 8.7.5.2 Minimum Requirement TDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with TDD PCell are specified in Table 8.7.5.2-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.5.2-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.2-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.2-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.5.2-1 is not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.2-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | | | Number of bits of a DL-SCH transport block received within a TTI (for normal/special subframe for TDD, except for subframe #5) | | Measurement channel | | Reference value |
| Total | FDD CC | TDD CC | FDD CC | TDD CC | FDD CC | TDD CC | TB success rate [%] |
| 1 | 2x20 | 20 | 20 | 75376 | 75376/0 | R.31-4 FDD | R.31-4 TDD | 85 |
| 2 | 10+20 | 10 | 20 | 36696 | 75376/0 | R.31-3A FDD | R.31-4 TDD | 85 |
| 2A | 15+20 | 15 | 20 | 55056 | 75376/0 | R.31-5 FDD | R.31-4 TDD | 85 |
| 3 | 10+10 | 10 | 10 | 36696 | 36696/0 | R.31-3A FDD | R.31-6 TDD | 85 |
| 4 | 3x20 | 20 | 2x20 | 75376 | 75376/0 | R.31-4 FDD | R.31-4 TDD | 85 |
| 5 | 15+20+20 | 15 | 2x20 | 55056 | 75376/0 | R.31-5 FDD | R.31-4 TDD | 85 |
| 6 | 10+20+20 | 10 | 2x20 | 36696 | 75376/0 | R.31-3A FDD | R.31-4 TDD | 85 |

Table 8.7.5.2-2: Test points for sustained data rate (FRC 64QAM)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | | | **Cat. 1** | **Cat. 2** | **Cat. 3** | **Cat. 4** | **Cat. 6, 7** | **Cat. 9,10** | **Cat. 11, 12,** |
| **Total** | **FDD CC** | **TDD CC** | **DL Cat. 6,7** | **DL Cat. 9, 10** | **DL Cat. 11, 12** |
| CA with 2CCs | 2x20 | 20 | 20 | - | - | 3 | 3 | 1 | 1 | - |
| 10+20 | 10 | 20 | - | - | 3 | 3 | 2 | 2 | - |
| 15+20 | 15 | 20 | - | - | 3 | 3 | 2A | 2A | - |
| CA with 3CCs | 3x20 | 20 | 2x20 | - | - | - | - | 1 | 4 | 4 |
| 15+20+20 | 15 | 2x20 | - | - | - | - | 2A | 5 | 5 |
| 10+20+20 | 10 | 2x20 | - | - | - | - | 2 | 6 | 6 |
| Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.  Note 2: Void. | | | | | | | | | | |

Table 8.7.5.2-3: Minimum requirement (TDD FDD CA 256QAM)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | | | **Measurement channel** | | **Reference value** |
| **Total** | **FDD CC** | **TDD CC** | **FDD CC** | **TDD CC** | **TB success rate [%]** |
| 1 | 2x20 | 20 | 20 | R.68 FDD | R.68 TDD | 85 |
| 2 | 10+20 | 10 | 20 | R.68-2 FDD | R.68 TDD | 85 |
| 3 | 15+20 | 15 | 20 | R.68-1 FDD | R.68 TDD | 85 |
| 4 | 3x20 | 20 | 2x20 | R.68 FDD | R.68 TDD | 85 |
| 5 | 15+20+20 | 15 | 2x20 | R.68-1 FDD | R.68 TDD | 85 |
| 6 | 10+20+20 | 10 | 2x20 | R.68-2 FDD | R.68TDD | 85 |

Table 8.7.5.2-4: Test points for sustained data rate (FRC 256QAM)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CA config** | **Maximum supported Bandwidth/ Bandwidth combination (MHz)** | | | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| **Total** | **FDD CC** | **TDD CC** | **DL Cat. 11, 12** |
| CA with 2CCs | 2x20 | 20 | 20 | 1 | 1 |  |  |  |  |
| 10+20 | 10 | 20 | 2 | 2 |  |  |  |  |
| 15+20 | 15 | 20 | 3 | 3 |  |  |  |  |
| CA with 3CCs | 3x20 | 20 | 2x20 | 4 | 1 |  |  |  |  |
| 15+20+20 | 15 | 2x20 | 5 | 3 |  |  |  |  |
| 10+20+20 | 10 | 2x20 | 6 | 2 |  |  |  |  |
| Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled. | | | | | | | | | |

### 8.7.6 FDD (DC)

The parameters specified in Table 8.7.6-1 are valid for all FDD DC tests unless otherwise stated.

Table 8.7.6-1: 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 and 256QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | | |  | Not configured | |
| Propagation condition | | | |  | Static propagation condition  No external noise sources are applied | |
| Transmission mode | | | |  | TM3 | |
| Codebook subset restriction | | | |  | 10 | |
| Antenna configuration | | | |  | 2x2 | |
| at antenna port (dBm/15kHz) | | | |  | -85 | |
| Symbols for unused PRBs | | | |  | OP.1 FDD | |
| ACK/NACK feedback mode | | | |  | Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG | |
| Time offset between MCG CC and SCG CC | | | | μs | 0 for UE under test supporting synchronous dual connectivity;  500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1) | |
| Downlink power allocation | |  | | dB | -3 | |
|  | | dB | -3 | |
| σ | | dB | 0 | |
| Note 1: Asynchronous and synchrous dual connectivity are defined in TS36.300 [11].  Note 2: If the UE supports both SCG bearer and Split bearer, the Split bearer is configured. | | | | | | |

For UE not supporting 256QAM, the requirements are specified in Table 8.7.6-2, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.6-3. The TB success rate across CGs shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.6-4, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.6-5. The TB success rate across CGs shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.6-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.6-2: Minimum requirement (DC 64QAM)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth combination (MHz)** | **Number of bits of a DL-SCH transport block received within a TTI** | **Measurement channel** | **Reference value**  **TB success rate(%)** | | |
| **DRB type of Split bearer (Note 2)** | **DRB type of SCG bearer (Note 3)** | |
| **MCG** | **SCG** |
| 1 | 2x10 | 25456 | R.31-2 FDD | 95 | 95 | 95 |
| 2 | 2x10 | 36696 (Note 4) | R.31-3A FDD | 85 | 85 | 85 |
| 3 | 10+20 | 36696 (Note 4) for 10MHz CC  75376 (Note 5) for 20MHz CC | R.31-3A FDD for 10MHz CC  R.31-4 FDD for 20MHz CC | 85 | 85 | 85 |
| 4 | 2x15 | 55056 (Note 6) | R.31-4B FDD | 85 | 85 | 85 |
| 5 | 15+20 | 55056 for 15MHz CC  75376 (Note 5) for 20MHz CC | R.31-5 FDD for 15MHz CC  R.31-4 FDD for 20MHz CC | 85 | 85 | 85 |
| 6 | 2x20 | 75376 (Note 5) | R.31-4 FDD | 85 | 85 | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.  Note 3: For the configuration of DRB type of SCG bearer,the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.  Note 4: 35160 bits for sub-frame 5.  Note 5: 71112 bits for sub-frame 5.  Note 6: 52752 bits for sub-frame 5. | | | | | | |

Table 8.7.6-3: Test points for sustained data rate (FRC DC 64QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **DC config** | **Maximum supported Bandwidth combination (MHz)** | **Cat. 3** | **Cat. 4** | **Cat. 6, 7** | **Cat. 9, 10** | **Cat. 11, 12** |  |
| DC with 2CCs | 2x10 | 1 | 2 | 2 | 2 | - |  |
| 10+20 | 1 | 2 | 3 | 3 | - |  |
| 2x15 | 1 | 2 | 4 | 4 | - |  |
| 15+20 | 1 | 2 | 5 | 5 | - |  |
| 2x20 | 1 | 2 | 6 | 6 | - |  |

Table 8.7.6-4: Minimum requirement (DC 256QAM)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth combination (MHz)** | **Measurement channel** | **Reference value**  **TB success rate (%)** | | |
| **DRB type of Split bearer (Note 2)** | **DRB type of SCG bearer (Note 3)** | |
| **MCG** | **SCG** |
| 1 | 2x10 | R.68-2 FDD | 85 | 85 | 85 |
| 2 | 10+20 | R.68-2 FDD for 10MHz CC  R.68 FDD for 20MHz CC | 85 | 85 | 85 |
| 3 | 2x15 | R.68-1 FDD | 85 | 85 | 85 |
| 4 | 15+20 | R.68-1 FDD for 15MHz CC  R.68 FDD for 20MHz CC | 85 | 85 | 85 |
| 5 | 2x20 | R.68 FDD | 85 | 85 | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.  Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately. | | | | | |

Table 8.7.6-5: Test points for sustained data rate (FRC DC 256QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **DC config** | **Maximum supported Bandwidth combination (MHz)** | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| **DL Cat 11, 12** |
| DC with 2CCs | 2x10 | 1 | 1 |  |  |  |  |
| 10+20 | 2 | 2 |  |  |  |  |
| 2x15 | 3 | 3 |  |  |  |  |
| 15+20 | 4 | 4 |  |  |  |  |
| 2x20 | 5 | 5 |  |  |  |  |

### 8.7.7 TDD (DC)

The parameters specified in Table 8.7.7-1 are valid for all TDD DC tests unless otherwise stated.

Table 8.7.7-1: Common Test Parameters (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** | | |
| Uplink downlink configuration | | | |  | 2 (Note 2) | |
| Special subframe configuration | | | |  | 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 | | | |  | {0,0,1,2} for 64QAM and 256QAM | |
| Number of OFDM symbols for PDCCH per component carrier | | | | OFDM symbols | 1 | |
| Cross carrier scheduling | | | |  | Not configured | |
| Propagation condition | | | |  | Static propagation condition  No external noise sources are applied | |
| Transmission mode | | | |  | TM3 | |
| Codebook subset restriction | | | |  | 10 | |
| Antenna configuration | | | |  | 2x2 | |
| at antenna port (dBm/15kHz) | | | |  | -85 | |
| Symbols for unused PRBs | | | |  | OP.1 TDD | |
| ACK/NACK feedback mode | | | |  | Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG | |
| Time offset between MCG CC and SCG CC | | | | μs | 0 for UE under test supporting synchronous dual connectivity;  500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1) | |
| Downlink power allocation |  | | | dB | -3 | |
|  | | | dB | -3 | |
| σ | | | dB | 0 | |
| Note 1: Asynchronous and synchrous dual connectivity are defined in TS36.300 [11].  Note 2: If the UE supports both SCG bearer and Split bearer, the Split bearer is configured. | | | | | | |

For UE not supporting 256QAM, the requirements are specified in Table 8.7.7-2, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.7-3. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.7-4, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.7-5. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.7-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.7-2: Minimum requirement (DC 64QAM)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth combination (MHz)** | **Number of bits of a DL-SCH transport block received within a TTI** | **Measurement channel** | **Reference value**  **TB success rate across CGs(%)** | | |
| **DRB type of Split bearer (Note 2)** | **DRB type of SCG bearer (Note 3)** | |
| **MCG** | **SCG** |
| 1 | 2x20 | 75376/0 (Note 4) | R.31-4A TDD | 85 | 85 | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: For the configuration of DRB type of Split bearer,the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.  Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.  Note 4: 71112 bits for sub-frame 5. | | | | | | |

Table 8.7.7-3: Test points for sustained data rate (FRC DC 64QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **DC config** | **Maximum supported Bandwidth combination (MHz)** | **Cat. 3** | **Cat. 4** | **Cat. 6, 7** | **Cat. 9, 10** | **Cat. 11, 12** |  |
| DC with 2CCs | 2x20 | - | - | 1 | 1 | - |  |

Table 8.7.7-4: Minimum requirement (DC 256QAM)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth combination (MHz)** | **Measurement channel** | **Reference value**  **TB success rate (%)** | | |
| **DRB type of Split bearer (Note 2)** | **DRB type of SCG bearer (Note 3)** | |
| **MCG** | **SCG** |
| 1 | 2x20 | R.68-3 TDD | 85 | 85 | 85 |
| Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.  Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.  Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately. | | | | | |

Table 8.7.7-5: Test points for sustained data rate (FRC DC 256QAM)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **DC config** | **Maximum supported Bandwidth combination (MHz)** | **Cat. 11, 12** | **DL Cat. 13** |  |  |  |  |
| **DL Cat. 11, 12** |
| DC with 2CCs | 2x20 | 1 | 1 |  |  |  |  |

## 8.8 Demodulation of EPDCCH

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.8.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

### 8.8.1 Distributed Transmission

#### 8.8.1.1 FDD

The parameters specified in Table 8.8.1.1-1 are valid for all FDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.1-1: Test Parameters for Distributed EPDCCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Number of PDCCH symbols | | symbols | 2 (Note 1) |
| PHICH duration | |  | Normal |
| Unused RE-s and PRB-s | |  | OCNG |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
| δ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Cyclic prefix | |  | Normal |
| Subframe Configuration | |  | Non-MBSFN |
| Precoder Update Granularity | | PRB | 1 |
| ms | 1 |
| Beamforming Pre-Coder | |  | Annex B. 4.4 |
| Cell Specific Reference Signal | |  | Port 0 and 1 |
| Number of EPDCCH Sets Configured | |  | 2 (Note 2) |
| Number of PRB per EPDCCH Set | |  | 4 (1st Set)  8 (2nd Set) |
| EPDCCH Subframe Monitoring | |  | NA |
| PDSCH TM | |  | TM3 |
| DCI Format | |  | 2A |
| Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.  Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured. | | | |

For the parameters specified in Table 8.8.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.1-2: Minimum performance Distributed EPDCCH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 ECCE | R.55 FDD | OP.7 FDD | EVA5 | 2 x 2 Low | 1 | 2.60 |
| 2 | 10 MHZ | 16 ECCE | R.56 FDD | OP.7 FDD | EVA70 | 2 x 2 Low | 1 | -3.20 |

##### 8.8.1.1.1 Void

Table 8.8.1.1.1-1: Void

#### 8.8.1.2 TDD

The parameters specified in Table 8.8.1.2-1 are valid for all TDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.2-1: Test Parameters for Distributed EPDCCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Number of PDCCH symbols | | symbols | 2 (Note 1) |
| PHICH duration | |  | Normal |
| Unused RE-s and PRB-s | |  | OCNG |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | -3 |
|  | dB | -3 |
| σ | dB | 0 |
| δ | dB | 3 |
| at antenna port | | dBm/15kHz | -98 |
| Cyclic prefix | |  | Normal |
| Subframe Configuration | |  | Non-MBSFN |
| Precoder Update Granularity | | PRB | 1 |
| ms | 1 |
| Beamforming Pre-Coder | |  | Annex B. 4.4 |
| Cell Specific Reference Signal | |  | Port 0 and 1 |
| Number of EPDCCH Sets Configured | |  | 2 (Note 2) |
| Number of PRB per EPDCCH Set | |  | 4 (1st Set)  8 (2nd Set) |
| EPDCCH Subframe Monitoring | |  | NA |
| PDSCH TM | |  | TM3 |
| DCI Format | |  | 2A |
| TDD UL/DL Configuration | |  | 0 |
| TDD Special Subframe | |  | 1 (Note 3) |
| Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.  Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.  Note 3: Demodulation performance is averaged over normal and special subframe. | | | |

For the parameters specified in Table 8.8.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.2-2: Minimum performance Distributed EPDCCH

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 ECCE | R.55 TDD | OP.7 TDD | EVA5 | 2 x 2 Low | 1 | 2.80 |
| 2 | 10 MHZ | 16 ECCE | R.56 TDD | OP.7 TDD | EVA70 | 2 x 2 Low | 1 | -3.10 |

##### 8.8.1.2.1 Void

Table 8.8.1.2.1-1: Void

### 8.8.2 Localized Transmission with TM9

#### 8.8.2.1 FDD

The parameters specified in Table 8.8.2.1-1 are valid for all FDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.1-1: Test Parameters for Localized EPDCCH with TM9

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Number of PDCCH symbols | | symbols | 1 (Note 1) |
| EPDCCH starting symbol | | symbols | 2 (Note 1) |
| PHICH duration | |  | Normal |
| Unused RE-s and PRB-s | |  | OCNG |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
|  | dB | -3 |
|  | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Cyclic prefix | |  | Normal |
| Subframe Configuration | |  | Non-MBSFN |
| Precoder Update Granularity | | PRB | 1 |
| ms | 1 |
| Beamforming Pre-Coder | |  | Annex B.4.5 |
| Cell Specific Reference Signal | |  | Port 0 and 1 |
| CSI-RS Reference Signal | |  | Port 15 and 16 |
| CSI-RS reference signal resource configuration | |  | 0 |
| CSI reference signal subframe configuration *I*CSI-RS | |  | 2 |
| ZP-CSI-RS configuration bitmap | |  | 0000010000000000 |
| ZP-CSI-RS subframe configuration *I*ZP-CSI-RS | |  | 2 |
| Number of EPDCCH Sets | |  | 2 (Note 2) |
| EPDCCH Subframe Monitoring pattern  *subframePatternConfig-r11* | |  | 1111111110 1111111101 1111111011 1111110111 (Note 3) |
| PDSCH TM | |  | TM9 |
| Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.  Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.  Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled. | | | |

For the parameters specified in Table 8.8.2.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.1-2: Minimum performance Localized EPDCCH with TM9

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 2 ECCE | R.57 FDD | OP.7 FDD | EVA5 | 2 x 2 Low | 1 | 12.2 |
| 2 | 10 MHZ | 8 ECCE | R.58 FDD | OP.7 FDD | EVA5 | 2 x 2 Low | 1 | 2.5 |

##### 8.8.2.1.1 Void

Table 8.8.2.1.1-1: Void

##### 8.8.2.1.2 Void

Table 8.8.2.1.2-1: Void

Table 8.8.2.1.2-2: Void

Table 8.8.2.1.2-3: Void

#### 8.8.2.2 TDD

The parameters specified in Table 8.8.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.2-1: Test Parameters for Localized EPDCCH with TM9

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Number of PDCCH symbols | | symbols | 1 (Note 1) |
| EPDCCH starting symbol | | symbols | 2 (Note 1) |
| PHICH duration | |  | Normal |
| Unused RE-s and PRB-s | |  | OCNG |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
|  | dB | -3 |
|  | dB | 0 |
| at antenna port | | dBm/15kHz | -98 |
| Cyclic prefix | |  | Normal |
| Subframe Configuration | |  | Non-MBSFN |
| Precoder Update Granularity | | PRB | 1 |
| ms | 1 |
| Beamforming Pre-Coder | |  | Annex B.4.5 |
| Cell Specific Reference Signal | |  | Port 0 and 1 |
| CSI-RS Reference Signal | |  | Port 15 and 16 |
| CSI-RS reference signal resource configuration | |  | 0 |
| CSI reference signal subframe configuration *I*CSI-RS | |  | 0 |
| ZP-CSI-RS configuration bitmap | |  | 0000010000000000 |
| ZP-CSI-RS subframe configuration *I*ZP-CSI-RS | |  | 0 |
| Number of EPDCCH Sets | |  | 2 (Note 2) |
| EPDCCH Subframe Monitoring pattern  *subframePatternConfig-r11* | |  | 1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3) |
| PDSCH TM | |  | TM9 |
| TDD UL/DL Configuration | |  | 0 |
| TDD Special Subframe | |  | 1 (Note 4) |
| Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.  Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.  Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.  Note 4: Demodulation performance is averaged over normal and special subframe. | | | |

For the parameters specified in Table 8.8.2.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.2.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.2-2: Minimum performance Localized EPDCCH with TM9

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 2 ECCE | R.57 TDD | OP.7 TDD | EVA5 | 2 x 2 Low | 1 | 12.8 |
| 2 | 10 MHZ | 8 ECCE | R.58 TDD | OP.7 TDD | EVA5 | 2 x 2 Low | 1 | 2.0 |

##### 8.8.2.2.1 Void

Table 8.8.2.2.1-1: Void

##### 8.8.2.2.2 Void

Table 8.8.2.2.2-1: Void

Table 8.8.2.2.2-2: Void

Table 8.8.2.2.2-3: Void

### 8.8.3 Localized transmission with TM10 Type B quasi co-location type

#### 8.8.3.1 FDD

For the parameters specified in Table 8.8.3.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.1-2. In Table 8.8.3.1-1, transmission point 1 (TP 1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.1-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| TP 1 | TP 2 | TP 1 | TP 2 |
| PHICH duration | | |  | Normal | | | |
| Downlink power allocation | |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -3 | | | |
|  | dB | 0 | | | |
|  | | | dB | 0dB power imbalance is considered between TP 1 and TP 2, | Reference value in Table 8.8.3.1-2 | Reference value in Table 8.8.3.1-2 | Reference value in Table 8.8.3.1-2 |
| at antenna port | | | dBm/15kHz | -98 | | | |
| Bandwidth | | | MHz | 10 | 10 | 10 | 10 |
| Number of configured EPDCCH Sets | | |  | 2 (Note 1) | | 2 (Note1) | |
| EPDCCH-PRB-Set ID (setConfigId) | | |  | 0 | 1 | 0 | 1 |
| Transmission type of EPDCCH-PRB-set | | |  | Localized | Localized | Localized | Localized |
| Number of PRB pair per EPDCCH-PRB-set | | | PRB | 8 | 8 | 8 | 8 |
| EPDCCH beamforming model | | |  | Annex B.4.5 | Annex B.4.5 | Annex B.4.5 | Annex B.4.5 |
| PDSCH transmission mode | | |  | TM10 | TM10 | TM10 | TM10 |
| PDSCH transmission scheduling | | |  | Blanked in all the subframes | Transmit in all the subframes | Probability of occurrence of PDSCH transmission is 30% (Note 3) | Probability of occurrence of PDSCH transmission is 70% (Note 3) |
| Non-zero power CSI reference signal (NZPId=1) | CSI reference signal configuration | |  | N/A | 0 | N/A | 0 |
| CSI reference signal subframe configuration *I*CSI-RS | |  | N/A | 2 | N/A | 2 |
| Non-zero power CSI reference signal (NZPId=2) | CSI reference signal configuration | |  | N/A | N/A | 10 | N/A |
| CSI reference signal subframe configuration *I*CSI-RS | |  | N/A | N/A | 2 | N/A |
| Zero power CSI reference signal  (ZPId=1) | CSI-RS Configuration list (ZeroPowerCSI-RS bitmap) | | Bitmap | N/A | 0000010000000000 | N/A | 1000010000000000 |
| CSI-RS subframe configuration *I*CSI-RS | |  | N/A | 2 | N/A | 2 |
| Zero power CSI reference signal  (ZPId=2) | CSI-RS Configuration list (ZeroPowerCSI-RS bitmap) | | Bitmap | N/A | N/A | 1000010000000000 | N/A |
| CSI-RS subframe configuration *I*CSI-RS | |  | N/A | N/A | 2 | N/A |
| PQI set 0  (Note 4) | Non-Zero power CSI RS Identity (NZPId) | |  | N/A | 1 | N/A | 1 |
| Zero power CSI RS Identity (ZPId) | |  | N/A | 1 | N/A | 1 |
| PQI set 1  (Note 4) | Non-Zero power CSI RS Identity (NZPId) | |  | N/A | N/A | 2 | N/A |
| Zero power CSI RS Identity (ZPId) | |  | N/A | N/A | 2 | N/A |
| Number of PDCCH symbols | | | Symbols | 1 (Note 2) | | | |
| EPDCCH starting position | | |  | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) |
| Subframe configuration | | |  | Non-MBSFN | Non-MBSFN | Non-MBSFN | Non-MBSFN |
| Time offset between TPs | | | μs | N/A | 2 | N/A | 2 |
| Frequency shift between TPs | | | Hz | N/A | 200 | N/A | 200 |
| Cell ID | | |  | 0 | 126 | 0 | 126 |
| Note 1: Resource blocks nPRB =0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.  Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11. And CFI is set to 1.  Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.  Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP. | | | | | | | |

Table 8.8.3.1-2: Minimum Performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 2 ECCE | R.59 FDD | OP.7 FDD | EVA5 | 2 x 2 Low | 1 | 13.4 |
| 2 | 2 ECCE | R.59 FDD | OP.7 FDD | EVA5 | 2 x 2 Low | 1 | 13.4 |

#### 8.8.3.2 TDD

For the parameters specified in Table 8.8.3.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.2-2. In Table 8.8.3.2-1, transmission point 1 (TP1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.2-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| TP 1 | TP 2 | TP 1 | TP 2 |
| PHICH duration | | |  | Normal | | | |
| Downlink power allocation | |  | dB | 0 | | | |
|  | dB | 0 | | | |
|  | dB | -3 | | | |
|  | dB | 0 | | | |
|  | | | dB | 0dB power imbalance is considered between TP 1 and TP 2, | Reference value in Table 8.8.3.2-2 | Reference value in Table 8.8.3.2-2 | Reference value in Table 8.8.3.2-2 |
| at antenna port | | | dBm/15kHz | -98 | | | |
| Bandwidth | | | MHz | 10 | 10 | 10 | 10 |
| Number of EPDCCH Sets | | |  | 2 (Note 1) | | 2 (Note1) | |
| EPDCCH-PRB-Set ID (setConfigId) | | |  | 0 | 1 | 0 | 1 |
| Transmission type of EPDCCH-PRB-set | | |  | Localized | Localized | Localized | Localized |
| Number of PRB pair per EPDCCH-PRB-set | | | PRB | 8 | 8 | 8 | 8 |
| EPDCCH beamforming model | | |  | Annex B.4.5 | Annex B.4.5 | Annex B.4.5 | Annex B.4.5 |
| PDSCH transmission mode | | |  | TM10 | TM10 | TM10 | TM10 |
| PDSCH transmission scheduling | | |  | Blanked in all the subframes | Transmit in all the subframes | Probability of occurrence of PDSCH transmission is 30% (Note 3) | Probability of occurrence of PDSCH transmission is 70% (Note 3) |
| CSI reference signal configurations | | |  | Antenna ports 15,16 | Antenna ports 15,16 | Antenna ports 15,16 | Antenna ports 15,16 |
| Non-zero power CSI reference signal (NZPId=1) | CSI reference signal configuration | |  | N/A | 0 | N/A | 0 |
| CSI reference signal subframe configuration *I*CSI-RS | |  | N/A | 0 | N/A | 0 |
| Non-zero power CSI reference signal (NZPId=2) | CSI reference signal configuration | |  | N/A | N/A | 10 | N/A |
| CSI reference signal subframe configuration *I*CSI-RS | |  | N/A | N/A | 0 | N/A |
| Zero power CSI reference signal  (ZPId=1) | CSI-RS Configuration list (ZeroPowerCSI-RS bitmap) | | Bitmap | N/A | 0000010000000000 | N/A | 1000010000000000 |
| CSI-RS subframe configuration *I*CSI-RS | |  | N/A | 0 | N/A | 0 |
| Zero power CSI reference signal  (ZPId=2) | CSI-RS Configuration list (ZeroPowerCSI-RS bitmap) | | Bitmap | N/A | N/A | 1000010000000000 | N/A |
| CSI-RS subframe configuration *I*CSI-RS | |  | N/A | N/A | 0 | N/A |
| PQI set 0  (Note 4) | Non-Zero power CSI RS Identity (NZPId) | |  | N/A | 1 | N/A | 1 |
| Zero power CSI RS Identity (ZPId) | |  | N/A | 1 | N/A | 1 |
| PQI set 1  (Note 4) | Non-Zero power CSI RS Identity (NZPId) | |  | N/A | N/A | 2 | N/A |
| Zero power CSI RS Identity (ZPId) | |  | N/A | N/A | 2 | N/A |
| Number of PDCCH symbols | | | Symbols | 1 (Note 2) | | | |
| EPDCCH starting position | | |  | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) | pdsch-Start-r11=2 (Note 2) |
| Subframe configuration | | |  | Non-MBSFN | Non-MBSFN | Non-MBSFN | Non-MBSFN |
| Time offset between TPs | | | μs | N/A | 2 | N/A | 2 |
| Frequency shift between TPs | | | Hz | N/A | 200 | N/A | 200 |
| Cell ID | | |  | 0 | 126 | 0 | 126 |
| TDD UL/DL configuration | | |  | 0 | | | |
| TDD special subframe | | |  | 1 | | | |
| Note 1: Resource blocks nPRB = 0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.  Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11. And CFI is set to 1.  Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.  Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP. | | | | | | | |

Table 8.8.3.2-2: Minimum Performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Aggregation level | Reference Channel | OCNG Pattern | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 2 ECCE | R.59 TDD | OP.7 TDD | EVA5 | 2 x 2 Low | 1 | 13.6 |
| 2 | 2 ECCE | R.59 TDD | OP.7 TDD | EVA5 | 2 x 2 Low | 1 | 13.6 |

## 8.9 Demodulation (single receiver antenna)

The SNR deifintion is given in Clause 8.1.1 where the number of receiver antennas NRX assumed for the minimum performance requirement in this clause is 1.

### 8.9.1 PDSCH

#### 8.9.1.1 FDD and half-duplex FDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

Table 8.9.1.1-1: Common Test Parameters (FDD and half-duplex 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 |
| Precoder update granularity |  | Frequency domain: 1 PRG  Time domain: 1 ms for Transmission mode 9 |

##### 8.9.1.1.1 Transmit diversity performance (Cell-Specific Reference Symbols)

8.9.1.1.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.1.1-2, with the addition of the parameters in Table 8.9.1.1.1.1-1 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 8.9.1.1.1.1-1: Test Parameters for Transmit diversity Performance (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 | | | |  | | 2 |
| Note 1: . | | | | | | |

Table 8.9.1.1.1.1-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  16QAM 1/2 | R.62 FDD | OP.1 FDD | EPA5 | 2x1 Low | 70 | 9.0 | 0 |

##### 8.9.1.1.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.9.1.1.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.2.1-2, with the addition of the parameters in Table 8.9.1.1.2.1-1 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 frequency selective precoding.

Table 8.9.1.1.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Test 1 | |
| Downlink power allocation |  | | dB | | -3 | |
|  | | dB | | -3 (Note 1) | |
| σ | | dB | | 0 | |
| at antenna port | | | dBm/15kHz | | -98 | |
| Precoding granularity | | | PRB | | 6 | |
| PMI delay (Note 2) | | | ms | | 8 | |
| Reporting interval | | | ms | | 8 | |
| Reporting mode | | |  | | PUSCH 1-2 | |
| CodeBookSubsetRestriction bitmap | | |  | | 001111 | |
| 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 8.9.1.1.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Band-width and MCS | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  64QAM 1/2 | R.63 FDD | OP.1 FDD | EPA5 | 2x1 Low | 70 | 13.2 | 0 |

##### 8.9.1.1.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.9.1.1.3.1 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 8.9.1.1.3.1-2 with the addition of the parameters in Table 8.9.1.1.3.1-1 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, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.1.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

|  |  |  |  |
| --- | --- | --- | --- |
| parameter | | Unit | Test 1 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (Note 1) |
| σ | dB | -3 |
| Beamforming model | |  | Annex B.4.1 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports 15,…,18 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 2 |
| CSI reference signal configuration | |  | 0 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 3 /  0001000000000000 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 6 |
| PDSCH transmission mode | |  | 9 |
| Note 1: .  Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.  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, which is QPSK modulated. | | | |

Table 8.9.1.1.3.1-2: 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 DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.64 FDD | OP.1 FDD | EPA5 | 2x1 Low | 70 | 4.7 | 0 |

#### 8.9.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.9.1.2-1: 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 | |
| Precoder update granularity | | |  | Frequency domain: 1 PRG  Time domain: 1 ms for Transmission mode 9 | |
| 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]. | | | | | |

##### 8.9.1.2.1 Transmit diversity performance (Cell-Specific Reference Symbols)

8.9.1.2.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.1.1-2, with the addition of the parameters in Table 8.9.1.2.1.1-1 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 8.9.1.2.1.1-1: 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 8.9.1.2.1.1-2: Minimum performance Transmit Diversity (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  16QAM 1/2 | R.62 TDD | OP.1 TDD | EPA5 | 2x1 Low | 70 | 8.8 | 0 |

##### 8.9.1.2.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.9.1.2.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.2.1-2, with the addition of the parameters in Table 8.9.1.2.2.1-1 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 frequency selective precoding.

Table 8.9.1.2.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Test 1 | |
| Downlink power allocation |  | | dB | | -3 | |
|  | | dB | | -3 (Note 1) | |
| σ | | dB | | 0 | |
| 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 | | |  | | 001111 | |
| 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. | | | | | | |

Table8.9.1.2.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | Reference Channel | OCNG Pattern | Propagation Condition | Correlation Matrix and Antenna Configuration | Reference value | | UE DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  64QAM 1/2 | R.63 TDD | OP.1 TDD | EPA5 | 2x1 Low | 70 | 13.1 | 0 |

##### 8.9.1.2.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.9.1.2.3.1 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 8.9.1.2.3.1-2 with the addition of the parameters in Table 8.9.1.2.3.1-1 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, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.2.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single 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 0,1 |
| CSI reference signals | |  | Antenna ports 15,…,18 |
| Beamforming model | |  | Annex B.4.1 |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | | Subframes | 5 / 4 |
| CSI reference signal configuration | |  | 1 |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | 4 / 0010000100000000 |
| at antenna port | | dBm/15kHz | -98 |
| Symbols for unused PRBs | |  | OCNG (Note 4) |
| Number of allocated resource blocks (Note 2) | | PRB | 6 |
| Simultaneous transmission | |  | No |
| PDSCH transmission mode | |  | 9 |
| Note 1: .  Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.  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, which is QPSK modulated. | | | |

Table 8.9.1.2.3.1-2: 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 DL category |
| Fraction of Maximum  Throughput (%) | SNR (dB) |
| 1 | 10 MHz  QPSK 1/3 | R.64 TDD | OP.1 TDD | EPA5 | 2x1 Low | 70 | 4.5 | 0 |

### 8.9.2 PHICH

#### 8.9.2.1 FDD and half-duplex FDD

##### 8.9.2.1.1 Transmit diversity 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 8.9.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.1.1-1: 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.19 | OP.1 FDD | EPA5 | 2 x 1 Low | 0.1 | 8.6 |

#### 8.9.2.2 TDD

##### 8.9.2.2.1 Transmit diversity 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 8.9.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.2.1-1: 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 | EPA5 | 2 x 1 Low | 0.1 | 8.6 |

### 8.9.3 PBCH

#### 8.9.3.1 FDD and half-duplex FDD

##### 8.9.3.1.1 Transmit diversity performance

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 8.9.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.1.1-1: 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.22 | EPA5 | 2 x 1 Low | 1 | -1.3 |

#### 8.9.3.2 TDD

##### 8.9.3.2.1 Transmit diversity 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 8.9.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.2.1-1: 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 1 Low | 1 | -1.7 |

# 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 and SINR are in accordance with the one given in clause 8.1.1.

For the performance requirements specified in this clause, it is assumed that *NRX*=2 unless otherwise stated.

Unless otherwise stated, 4-bit CQI Table in Table 7.2.3-1 in TS 36.213 [6], and Modulation and TBS index table in Table 7.1.7.1-1 for PDSCH in TS 36.213 [6] are applied in all the CSI requirements.

### 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.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

#### 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 and 3 DL CCs in Table 9.1.1.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

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, 5+5 MHz, and 10MHz+5MHz. |
| 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

Table 9.1.1.2-2: Applicability and test rules for CA UE CQI tests with 3 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 3CCs in Clause 9.6.1.1 | Any of 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 3CCs 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

#### 9.1.1.2A Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD 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 TDD-FDD CA in Table 9.1.1.2A-1 and for 3 DL TDD-FDD CA in Table 9.1.1.2A-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 9.1.1.2A-1: Applicability and test rules for CA UE CQI tests for TDD-FDD CA 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 9.6.1.3 | Any of one of the supported CA capabilities | Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 2CCs in Clause 9.6.1.4 | Any of one of the supported CA capabilities | Any one of the supported TDD-FDD CA configurations with TDD PCell 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

Table 9.1.1.2A-2: Applicability and test rules for CA UE CQI tests for TDD-FDD CA with 3 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 3CCs in Clause 9.6.1.3 | Any of one of the supported CA capabilities | Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination | Largest aggregated CA bandwidth combination |
| CA tests with 3CCs in Clause 9.6.1.4 | Any of one of the supported CA capabilities | Any one of the supported TDD-FDD CA configurations with TDD PCell 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 1.  Note 3: A single Uplink CC is configured for all tests | | | |

#### 9.1.1.3 Test coverage for different number of componenet carriers

For FDD CA tests specified in 9.6.1.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 9.6.1.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 9.6.1.3 and 9.6.1.4, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

## 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. For the parameters specified in Table 9.2.1.1-1 and Table 9.2.1.1-2, 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 / RC.14 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.

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.2.1.1-2 is defined in 9.1.1.1.

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 RC.1 FDD according 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. | | | | | | |

Table 9.2.1.1-2: PUCCH 1-0 static test (FDD 5MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 5 | | | |
| 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 RC.14 FDD according 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.15 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. 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. 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. 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 | | |
| 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 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. | | | | | | | | | | |

#### 9.2.1.5 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category ≥2. For the parameters specified in Table 9.2.1.5-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 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.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets CCSI,0 is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, 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 + 2) 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.

Table 9.2.1.5-1: PUCCH 1-0 static test (FDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 and 3 | Cell 1 | | Cell 2 and 3 |
| 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 | | Cell 2: 12  Cell 3: 10 | 13 | 14 | Cell 2: 12  Cell 3: 10 |
| at antenna port |  | | dBm/15kHz | -98 (Note 7) | | | N/A | -98 (Note 7) | | N/A |
|  | | dBm/15kHz | -98 (Note 8) | | | N/A | -98 (Note 8) | | N/A |
|  | | dBm/15kHz | -93 (Note 9) | | | N/A | -93 (Note 9) | | N/A |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN |
| Cell Id | | |  | 0 | | | Cell 2: 6  Cell 3: 1 | 0 | | Cell 2: 6  Cell 3: 1 |
| Time Offset between Cells | | | μs | Cell 2: 3 usec  Cell 3: -1usec | | | | Cell 2: 3 usec  Cell 3: -1usec | | |
| Frequency Shift between Cells | | | Hz | Cell 2: 300Hz  Cell 3: -100Hz | | | | Cell 2: 300Hz  Cell 3: -100Hz | | |
| 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 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are 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 and Cell 3 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 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.  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. | | | | | | | | | | |

#### 9.2.1.6 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category ≥2. For the parameters specified in Table 9.2.1.6-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 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.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets CCSI,0 is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, 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 + 2) 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.

Table 9.2.1.6-1: PUCCH 1-0 static test (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 and 3 | Cell 1 | | Cell 2 and 3 |
| 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 | | Cell 2: 12  Cell 3: 10 | 13 | 14 | Cell 2: 12  Cell 3: 10 |
| at antenna port |  | | dBm/15kHz | -98 (Note 7) | | | N/A | -98 (Note 7) | | N/A |
|  | | dBm/15kHz | -98 (Note 8) | | | N/A | -98 (Note 8) | | N/A |
|  | | dBm/15kHz | -93 (Note 9) | | | N/A | -93 (Note 9) | | N/A |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN |
| Cell Id | | |  | 0 | | | Cell 2: 6  Cell 3: 1 | 0 | | Cell 2: 6  Cell 3: 1 |
| Time Offset between Cells | | | μs | Cell 2: 3 usec  Cell 3: -1usec | | | | Cell 2: 3 usec  Cell 3: -1usec | | |
| Frequency shift between Cells | | | Hz | Cell 2: 300Hz  Cell 3: -100Hz | | | | Cell 2: 300Hz  Cell 3: -100Hz | | |
| 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 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 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 and Cell 3 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 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.  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. | | | | | | | | | | |

#### 9.2.1.7 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and DL Category ≥11. For the parameters specified in Table 9.2.1.7-1, 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.1A 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, or the BLER using the transport format indicated by the (median CQI + 1) shall be less than or equal to 0.1 when the highest MCS value of the test case has reached. 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.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.2.1.7-1: 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 | -1 | 0 | 20 | 21 |
|  | | dB[mW/15kHz] | -99 | -98 | -78 | -77 |
|  | | 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 RC.1A 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. | | | | | | |

#### 9.2.1.8 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and UE DL Category ≥11. For the parameters specified in Table 9.2.1.8-1, 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.1A 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, or the BLER using the transport format indicated by the (median CQI + 1) shall be less than or equal to 0.1 when the highest MCS value of the test case has reached. 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.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.2.1.8-1: PUCCH 1-0 static test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | MHz | 20 | | | |
| 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 | -1 | 0 | 20 | 21 |
|  | | dB[mW/15kHz] | -99 | -98 | -78 | -77 |
|  | | 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.1A 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 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. | | | | | | |

### 9.2.2 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. 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. 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 – 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 9.2.2.2-1: 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. 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 | | | |
| 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) | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| 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. 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 | | | |
| 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) | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| 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. | | | | | | |

### 9.2.4 Minimum requirement PUCCH 1-1 (With Single CSI Process)

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.

#### 9.2.4.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.1-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, 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 9.2.4.1-1: PUCCH 1-1 static test (FDD)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | Test 2 | | |
| TP1 | TP2 | | TP1 | TP2 | |
| Bandwidth | | MHz | 10 | | | | | |
| PDSCH transmission mode | |  | 10 | | | | | |
| Downlink power allocation (Note 1) |  | dB | 0 | 0 | | 0 | 0 | |
|  | dB | 0 | 0 | | 0 | 0 | |
| Pc | dB | -3 | -3 | | -3 | -3 | |
| σ | dB | -3 | N/A | | -3 | N/A | |
| Cell ID | |  | 0 | | | 0 | | |
| Cell-specific reference signals | |  | Antenna ports 0, 1 | (Note 2) | | Antenna ports 0, 1 | (Note 2) | |
| CSI reference signals | |  | Antenna ports 15,…,18 | N/A | | Antenna ports 15,…,18 | N/A | |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | N/A | | 5/1 | N/A | |
| CSI-RS configuration | |  | 0 | N/A | | 0 | N/A | |
| Zero-Power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 1 /  0010000000000000 | 1 / 1000000000000000 | | 1 /  0010000000000000 | 1 / 1000000000000000 | |
| CSI-IM configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 1 /  0010000000000000 | N/A | | 1 /  0010000000000000 | N/A | |
| CSI process configuration  Signal/Interference/Reporting mode | |  | CSI-RS/CSI-IM/PUCCH 1-1 | | | CSI-RS/CSI-IM/PUCCH 1-1 | | |
| Propagation condition and antenna configuration | |  | Clause B.1  (4 x 2) | Clause B.1  (2 x 2) | | Clause B.1  (4 x 2) | Clause B.1  (2 x 2) | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0100 0000 | 100000 | | 0x0000 0000 0100 0000 | 100000 | |
| SNR (Note 3) | | dB | 20 | 6 | 7 | 20 | 14 | 15 |
|  | | dB[mW/15kHz] | -78 | -92 | -91 | -78 | -84 | -83 |
|  | | dB[mW/15kHz] | -98 | | | -98 | | |
| Modulation / Information bit payload | |  | (Note4) | QPSK / 4392 | | (Note4) | QPSK / 4392 | |
| Max number of HARQ transmissions | |  | 1 | N/A | | 1 | N/A | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note5) | N/A | | PUSCH (Note5) | N/A | |
| PUCCH Report Type for CQI/PMI | |  | 2 | N/A | | 2 | N/A | |
| PUCCH Report Type for RI | |  | 3 | N/A | | 3 | N/A | |
| Reporting periodicity | | ms | *N*pd = 5 | N/A | | *N*pd = 5 | N/A | |
| CQI Delay | | ms | 8 | N/A | | 8 | N/A | |
| *cqi-pmi-ConfigurationIndex* | |  | 2 | N/A | | 2 | N/A | |
| *ri-ConfigIndex* | |  | 1 | N/A | | 1 | N/A | |
| PDSCH scheduled sub-frames | |  | 1,2,3,4,6,7,8,9 | | | 1,2,3,4,6,7,8,9 | | |
| Timing offset between TPs | | us | 0 | | | 0 | | |
| Frequency offset between TPs | | Hz | 0 | | | 0 | | |
| Note1: Reference measurement channel RC.10 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: REs for antenna ports 0 and 1 CRS have zero transmission power.  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: N/A.  Note 5: 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. | | | | | | | | |

#### 9.2.4.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.2-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, 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 9.2.4.2-1: PUCCH 1-1 static test (TDD)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | Test 2 | | |
| TP1 | TP2 | | TP1 | TP2 | |
| Bandwidth | | MHz | 10 | | | | | |
| PDSCH transmission mode | |  | 10 | | | | | |
| Uplink downlink configuration | |  | 2 | | | | | |
| Special subframe configuration | |  | 4 | | | | | |
| Downlink power allocation (Note 1) |  | dB | 0 | 0 | | 0 | 0 | |
|  | dB | 0 | 0 | | 0 | 0 | |
| Pc | dB | -6 | -6 | | -6 | -6 | |
| σ | dB | -3 | N/A | | -3 | N/A | |
| Cell ID | |  | 0 | | | 0 | | |
| Cell-specific reference signals | |  | Antenna ports 0, 1 | (Note 2) | | Antenna ports 0, 1 | (Note 2) | |
| CSI reference signals | |  | Antenna ports 15,…,22 | N/A | | Antenna ports 15,…,22 | N/A | |
| CSI-RS periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | N/A | | 5/3 | N/A | |
| CSI-RS configuration | |  | 0 | N/A | | 0 | N/A | |
| Zero-Power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 /  0010000000000000 | 3 / 1000010000000000 | | 3 /  0010000000000000 | 3 / 1000010000000000 | |
| CSI-IM configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 /  0010000000000000 | N/A | | 3 /  0010000000000000 | N/A | |
| CSI process configuration  Signal/Interference/Reporting mode | |  | CSI-RS/CSI-IM/PUCCH 1-1 | | | CSI-RS/CSI-IM/PUCCH 1-1 | | |
| Propagation condition and antenna configuration | |  | Clause B.1  (8 x 2) | Clause B.1  (2 x 2) | | Clause B.1  (8 x 2) | Clause B.1  (2 x 2) | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0020 0000 0000 0001 0000 | 100000 | | 0x0000 0000 0020 0000 0000 0001 0000 | 100000 | |
| SNR (Note 3) | | dB | 17 | 6 | 7 | 17 | 14 | 15 |
|  | | dB[mW/15kHz] | -81 | -92 | -91 | -81 | -84 | -83 |
|  | | dB[mW/15kHz] | -98 | | | -98 | | |
| Modulation / Information bit payload | |  | (Note4) | QPSK / 4392 | | (Note4) | QPSK / 4392 | |
| Max number of HARQ transmissions | |  | 1 | N/A | | 1 | N/A | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note5) | N/A | | PUSCH (Note5) | N/A | |
| PUCCH Report Type for CQI/second PMI | |  | 2b | N/A | | 2b | N/A | |
| Physical channel for RI reporting | |  | PUSCH | N/A | | PUSCH | N/A | |
| PUCCH Report Type for RI/ first PMI | |  | 5 | N/A | | 5 | N/A | |
| Reporting periodicity | | ms | *N*pd = 5 | N/A | | *N*pd = 5 | N/A | |
| CQI Delay | | ms | 10 or 11 | N/A | | 10 or 11 | N/A | |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | N/A | | 3 | N/A | |
| *ri-ConfigIndex* | |  | 805 (Note 6) | N/A | | 805 (Note 6) | N/A | |
| *ACK/NACK feedback mode* | |  | Multiplexing | N/A | | Multiplexing | N/A | |
| PDSCH scheduled sub-frames | |  | 3,4,8,9 | | | 3,4,8,9 | | |
| Timing offset between TPs | | us | 0 | | | 0 | | |
| Frequency offset between TPs | | Hz | 0 | | | 0 | | |
| Note1: Reference measurement channel RC.10 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: REs for antenna ports 0 and 1 CRS have zero transmission power.  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: N/A.  Note 5: 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 6: 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. | | | | | | | | |

### 9.2.5 Minimum requirement PUCCH 1-1 (when *csi-SubframeSet –r12* and *EIMTA-MainConfigServCell-r12* are configured)

The following requirements apply to UE Category ≥2 which supports eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI and Rel-12 CSI subframe sets. For the parameters specified in table 9.2.5-1, and using the downlink physical channels specified in Tables C.3.2-1 and C.3.2-2, for each CSI subframe set, the reported CQI value shall be in the range of ±1 of the reported median more than 90% of the time. For each CSI subframe set, 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. The difference of the median CQI obtained by reports in CSI subframe sets CCSI,0 and the median CQI obtained by reports in CSI subframe sets CCSI,1 shall be larger than or equal to 3.

Table 9.2.5 -1: PUCCH 1-1 static test (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test** | |
| Bandwidth | | MHz | 10 | |
| PDSCH transmission mode | |  | 9 | |
| Uplink downlink configuration in SIB1 | |  | 0 | |
| Downlink HARQ reference configuration (eimta-HarqReferenceConfig-r12) (Note 4) | |  | 2 | |
| Set of dynamic TDD UL-DL configurations (Notes 4,5) | |  | {0, 2} | |
| Periodicity of monitoring the L1 reconfiguration DCI (eimta-CommandPeriodicity-r12) | | ms | 10 | |
| Set of subframes to monitor the L1 reconfiguration DCI (eimta-CommandSubframeSet-r12) | |  | SF#5 | |
| CSI-MeasSubframeSet-r12 | |  | 0001100011 | |
| Special subframe configuration | |  | 4 | |
| Downlink power allocation |  | dB | 0 | |
|  | dB | 0 | |
|  | dB | 0 | |
| σ | dB | -3 | |
| CRS reference signals | |  | Antenna ports 0, 1 | |
| CSI reference signals | |  | Antenna ports 15,16 | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/4 | |
| CSI reference signal configuration | |  | 4 | |
| Zero-Power CSI-RS configuration 0  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 0 /  0000010000000000 | |
| Zero-Power CSI-RS configuration 1  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 4 /  0100000000000000 | |
| Propagation condition and antenna configuration | |  | Clause B.1 (2 x 2) | |
| Beamforming Model | |  | As specified in Section B.4.3 | |
| CodeBookSubsetRestriction bitmap | |  | ‘000001’ | |
| SNR in CSI subframe set 0 | | dB | 0 | 1 |
| SNR in CSI subframe set 1 | | dB | 10 | 11 |
|  | | dB[mW/15kHz] | -98 | -97 |
| for CSI subframe set 0 | | dB[mW/15kHz] | -98 | -98 |
| for CSI subframe set 1 | | dB[mW/15kHz] | -108 | -108 |
| PDSCH scheduled subframes for CSI subframe set 0 | |  | 0,5 | |
| PDSCH scheduled subframes for CSI subframe set 1 | |  | 3,4,8,9 | |
| Max number of HARQ transmissions | |  | 1 | |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 6) | |
| 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 = 10 for each Rel-12 CSI subframe set | |
| CQI delay | | ms | 14 for CSI subframe set 0  12 for CSI subframe set 1 | |
| *cqi-pmi-ConfigurationIndex* | |  | 8 for set 0  13 for set 1 | |
| *ri-ConfigIndex* | |  | 805 for both set 0 and set 1 (Note 7) | |
| ACK/NACK feedback mode | |  | Multiplexing | |
| Note 1: Reference measurement channel RC.19 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD and dynamic OCNG Pattern with multiple non-contiguous blocks OP.7 TDD as described in Annex A.5.2.1/7 for CSI subframe set 0.  Note 2: Reference measurement channel RC.20 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 for CSI subframe set 1.  Note 3: In the test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level for each CSI subframe set separately.  Note 4: As specified in Table 4.2-2 in TS 36.211.  Note 5: UL/DL configuration in PDCCH with eIMTA-RNTI is cyclically selected from the given set on a per-DCI basis.  Note 6: 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#7 and #2. CQI/PMI reports for CSI subframe set 0 is transmitted in SF#2 and CQI/PMI reports for CSI subframe set 1 is transmitted in SF#7.  Note 7: 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 | ≥1 |

##### 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 | ≥1 |

##### 9.3.1.1.3 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.3-2 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 in ABS subframes 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 in ABS subframes for the indicated transport formats shall be greater than or equal to *ε*.

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 9.3.1.1.3-1 Sub-band test for single antenna transmission (FDD)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | | | |
| Cell 1 | | | Cell 2 and 3 | Cell 1 | | | | Cell 2 and 3 |
| Bandwidth | | | MHz | 10 | | | | 10 | | | | |
| PDSCH transmission mode | | |  | 1 | | Note 10 | | 1 | | Note 10 | | |
| Downlink power allocation | |  | dB | 0 | | | | 0 | | | | |
|  | dB | 0 | | | | 0 | | | | |
| σ | dB | 0 | | | | 0 | | | | |
| Propagation condition | | |  | Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz | | | EVA5  Low antenna correlation | Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz | | | EVA5  Low antenna correlation | |
| Antenna configuration | | |  | 1x2 | | | | 1x2 | | | | |
| (Note 1) | | | dB | 4 | 5 | | Cell 2: 12  Cell 3: 10 | 14 | 15 | Cell 2: 12  Cell 3: 10 | | |
| at antenna port |  | | dBm/15kHz | -98 (Note 7) | | | N/A | -98 (Note 7) | | N/A | | |
|  | | dBm/15kHz | -98 (Note 8) | | | N/A | -98 (Note 8) | | N/A | | |
|  | | dBm/15kHz | -93 (Note 9) | | | N/A | -93 (Note 9) | | N/A | | |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN | | |
| Cell Id | | |  | 0 | | | Cell 2: 6  Cell 3: 1 | 0 | | Cell 2: 6  Cell 3: 1 | | |
| Time Offset between Cells | | | μs | Cell 2: 3 usec  Cell 3: -1usec | | | | Cell 2: 3 usec  Cell 3: -1usec | | | | |
| Frequency Shift between Cells | | | Hz | Cell 2: 300Hz  Cell 3: -100Hz | | | | Cell 2: 300Hz  Cell 3: -100Hz | | | | |
| 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 | | | | |
| CQI delay | | | ms | 8 | | | | | | | | |
| Reporting interval (Note 13) | | | ms | 10 | | | | | | | | |
| Reporting mode | | |  | PUSCH 3-0 | | | | | | | | |
| Sub-band size | | | RB | 6 (full size) | | | | | | | | |
| 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]. 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 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 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are 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 and Cell 3 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.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 12: 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 13: The CSI reporting is such that reference subframes belong to Ccsi,0. | | | | | | | | | | | | |

Table 9.3.1.1.3-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| *ε* | 0.01 | 0.01 |
| UE Category | ≥1 | ≥1 |

##### 9.3.1.1.4 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.4-2 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 in ABS subframes 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 in ABS subframes for the indicated transport formats shall be greater than or equal to *ε*.

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 9.3.1.1.4-1: Sub-band test for single antenna transmission (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | | | Test 2 | | |
| Cell 1 | | | Cell 2 and 3 | Cell 1 | | Cell 2 and 3 |
| Bandwidth | | | MHz | 10 | | | | 10 | | |
| PDSCH transmission mode | | |  | 1 | | Note 10 | | 1 | | Note 10 |
| Uplink downlink configuration | | |  | 1 | | | | 1 | | |
| Special subframe configuration | | |  | 4 | | | | 4 | | |
| Downlink power allocation | |  | dB | 0 | | | | 0 | | |
|  | dB | 0 | | | | 0 | | |
| σ | dB | 0 | | | | 0 | | |
| Propagation condition | | |  | Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz | | EVA5  Low antenna correlation | | Clause B.2.4 with Td = 0.45 us, a = 1, fd = 5 Hz | | EVA5  Low antenna correlation |
| Antenna configuration | | |  | 1x2 | | | | 1x2 | | |
| (Note 1) | | | dB | 4 | 5 | | Cell 2: 12  Cell 3: 10 | 14 | 15 | Cell 2: 12  Cell 3: 10 |
| at antenna port |  | | dBm/15kHz | -98 (Note 7) | | | N/A | -98 (Note 7) | | N/A |
|  | | dBm/15kHz | -98 (Note 8) | | | N/A | -98 (Note 8) | | N/A |
|  | | dBm/15kHz | -93 (Note 9) | | | N/A | -93 (Note 9) | | N/A |
| Subframe Configuration | | |  | Non-MBSFN | | | Non-MBSFN | Non-MBSFN | | Non-MBSFN |
| Cell Id | | |  | 0 | | | Cell 2: 6  Cell 3: 1 | 0 | | Cell 2: 6  Cell 3: 1 |
| Time Offset between Cells | | | μs | Cell 2: 3 usec  Cell 3: -1usec | | | | Cell 2: 3 usec  Cell 3: -1usec | | |
| Frequency shift between Cells | | | Hz | Cell 2: 300Hz  Cell 3: -100Hz | | | | Cell 2: 300Hz  Cell 3: -100Hz | | |
| 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 | | |
| CQI delay | | | ms | 10 | | | | | | |
| Reporting interval (Note 13) | | | ms | 10 | | | | | | |
| Reporting mode | | |  | PUSCH 3-0 | | | | | | |
| Sub-band size | | | RB | 6 (full size) | | | | | | |
| 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]. 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 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 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 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 and Cell 3 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.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 12: 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 13: The CSI reporting is such that reference subframes belong to Ccsi,0. | | | | | | | | | | |

Table 9.3.1.1.4-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| *ε* | 0.01 | 0.01 |
| UE Category | ≥1 | ≥1 |

##### 9.3.1.1.5 TDD (when *csi-SubframeSet –r12* is configured)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets. For the parameters specified in Table 9.3.1.1.5-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.5-2 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 for each CSI subframe set;

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 ≥ for each CSI subframe set;

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 and less than 0.60 for each CSI subframe set.

d) the difference of the wide-band median CQI obtained by reports in CSI subframe sets CCSI,0 and the wide-band median CQI obtained by reports in CSI subframe sets CCSI,1 shall be larger than or equal to 3.

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 available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.1.5-1: Sub-band test for TDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test** | |
| Bandwidth | | MHz | 10 | |
| Transmission mode | |  | 2 | |
| Uplink downlink configuration | |  | 2 | |
| Special subframe configuration | |  | 4 | |
| CSI-MeasSubframeSet-r12 | |  | 0001100000 | |
| Downlink power allocation |  | dB | -3 | |
|  | dB | -3 | |
| σ | dB | 0 | |
| SNR in CSI subframe set 0 | | dB | 0 | 1 |
| SNR in CSI subframe set 1 | | dB | 10 | 11 |
|  | | dB[mW/15kHz] | -98 | -97 |
| for CSI subframe set 0 | | dB[mW/15kHz] | -98 | -98 |
| for CSI subframe set 1 | | dB[mW/15kHz] | -108 | -108 |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 2x2 | |
| CRS reference signals | |  | Antenna port 0 and 1 | |
| Zero-Power CSI-RS configuration 0  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 /  0000010000000000 | |
| Zero-Power CSI-RS configuration 1  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 4 /  0100000000000000 | |
| PDSCH scheduled subframes for CSI subframe set 0 | |  | 8,9 | |
| PDSCH scheduled subframes for CSI subframe set 1 | |  | 3,4 | |
| Reporting interval (Note 4) | | ms | 10 per subframe set | |
| CQI delay | | ms | 15 for CSI subframe set 0  15 for CSI subframe set 1 | |
| Reporting mode | |  | PUSCH 3-0 | |
| Sub-band size | | RB | 6 (full size) | |
| Max number of HARQ transmissions | |  | 1 | |
| ACK/NACK feedback mode | |  | Multiplexing | |
| Number of EPDCCH Sets Configured | |  | 2 (Note 5,6) | |
| Number of PRB per EPDCCH Set | |  | 4 | |
| EPDCCH Subframe Monitoring | |  | NA | |
| EPDCCH Aggregation level | |  | 8ECCE | |
| EPDCCH beamforming model | |  | Annex B.4.4 | |
| 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.17 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: In the test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level for each subframe set separately..  Note 4: For CSI subframe set 0, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF #7. For CSI subframe set 1, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2.  Note 5: In case UE supports EPDCCH, the PDSCH scheduling grants are transmitted via EPDCCH, otherwise PDCCH is used.  Note 6: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {0, 3, 6, 9} for the first set and PRB = {40, 43, 46, 49} for the second set. EPDCCH set is selected after scheduling decision for PDSCH to avoid collision between PDSCH and EPDCCH PRBs, respectively. EPDCCH is only transmitted from one set. The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling epdcch-StartSymbol-r11is not configured | | | | |

Table 9.3.1.1.5-2: Minimum requirement (TDD)

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

#### 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 | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CRS reference signals | |  | Antenna ports 0 | | | |
| CSI reference signals | |  | Antenna ports 15, 16 | | | |
| 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 | ≥1 |

##### 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 | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CRS reference signals | |  | Antenna port 0 | | | |
| CSI reference signals | |  | Antenna port 15,16 | | | |
| 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 | ≥1 |

##### 9.3.1.2.3 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.3-2 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.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.3.1.2.3-1 Sub-band test for FDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 10 MHz | |
| Transmission mode | |  | 9 | |
| Downlink power allocation |  | dB | 0 | |
|  | dB | 0 | |
|  | dB | 0 | |
| σ | dB | 0 | |
| SNR (Note 3) | | dB | 16 | 17 |
|  | | dB[mW/15kHz] | -82 | -81 |
|  | | dB[mW/15kHz] | -98 | -98 |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 2x2 | |
| Beamforming Model | |  | As specified in Section B.4.3 | |
| CRS reference signals | |  | Antenna ports 0 | |
| CSI reference signals | |  | Antenna ports 15, 16 | |
| 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.8A 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 9.3.1.2.3-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| ** [%] | 2 |
| ** [%] | 40 |
| ** | 1.1 |
| UE Category | 11-12 |
| UE DL Category | ≥11 |

##### 9.3.1.2.4 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.4-2 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.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.3.1.2.4-1 Sub-band test for TDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 20 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 | 16 | 17 |
|  | | dB[mW/15kHz] | -82 | -81 |
|  | | dB[mW/15kHz] | -98 | -98 |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 2x2 | |
| Beamforming Model | |  | As specified in Section B.4.3 | |
| CRS reference signals | |  | Antenna port 0 | |
| CSI reference signals | |  | Antenna port 15,16 | |
| 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 | 8 (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.8A 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 9.3.1.2.4-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| ** [%] | 2 |
| ** [%] | 40 |
| ** | 1.1 |
| UE Category | 11-12 |
| UE DL Category | ≥11 |

##### 9.3.1.2.5 Void

##### 9.3.1.2.6 TDD (when *csi-SubframeSet –r12* is configured with one CSI process)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets and TM10. For the parameters specified in Table 9.3.1.2.6-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.6-2 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 for each CSI subframe set;

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 ≥ for each CSI subframe set;

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 0.01 for each CSI subframe set.

d) The difference of the wide-band median CQI obtained by reports in CSI subframe sets CCSI,0 and the wide-band median CQI obtained by reports in CSI subframe sets CCSI,1 shall be larger than or equal to 3.

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 available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.6-1: Sub-band test for TDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test** | |
| Bandwidth | | MHz | 10 | |
| Transmission mode | |  | 10 | |
| Uplink downlink configuration | |  | 2 | |
| Special subframe configuration | |  | 4 | |
| CSI-MeasSubframeSet-r12 | |  | 0001100000 | |
| Downlink power allocation |  | dB | 0 | |
|  | dB | 0 | |
|  | dB | -3 | |
| σ | dB | -3 | |
| SNR in CSI subframe set 0 | | dB | 0 | 1 |
| SNR in CSI subframe set 1 | | dB | 10 | 11 |
|  | | dB[mW/15kHz] | -98 | -97 |
| for CSI subframe set 0 | | dB[mW/15kHz] | -98 | -98 |
| for CSI subframe set 1 | | dB[mW/15kHz] | -108 | -108 |
| Propagation channel | |  | Clause B.2.4 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 2x2 | |
| Beamforming Model | |  | As specified in Section B.4.3 | |
| CRS reference signals | |  | Antenna port 0 and 1 | |
| CSI reference signals | |  | Antenna port 15,16 | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 0 | |
| CSI-RS reference signal configuration | |  | 0 | |
| Zero-Power CSI-RS configuration 0  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 /  0000010000000000 | |
| Zero-Power CSI-RS configuration 1  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 4 /  0100000000000000 | |
| CSI-IM configuration 0  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 /  0000010000000000 | |
| CSI-IM configuration 1  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 4 /  0100000000000000 | |
| CSI process configuration  Signal/Interference/Reporting mode for CSI subframe set 0 | |  | CSI-RS/CSI-IM 0/PUSCH 3-1 | |
| CSI process configuration  Signal/Interference/Reporting mode for CSI subframe set 1 | |  | CSI-RS/CSI-IM 1/PUSCH 3-1 | |
| CodeBookSubsetRestriction bitmap | |  | 000001 | |
| Reporting interval (Note 4) | | ms | 10 per subframe set | |
| CQI delay | | ms | 15 for CSI subframe set 0  15 for CSI subframe set 1 | |
| Sub-band size | | RB | 6 (full size) | |
| PDSCH scheduled subframes for CSI subframe set 0 | |  | 8,9 | |
| PDSCH scheduled subframes for CSI subframe set 1 | |  | 3,4 | |
| 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.18 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 for each subframe set separately.  Note 4: For CSI subframe set 0, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF #7. For CSI subframe set 1, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2. | | | | |

Table 9.3.1.2.6-2: Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test |
| ** [%] | 2 |
| ** [%] | 55 |
| ** | 1.02 |
| UE Category | ≥1 |

### 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 Table 9.3.2.1.1-3, 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 Table 9.3.2.1.1-4 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

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.3.2.1.1-3 and Table 9.3.2.1.1-4 is defined in 9.1.1.1.

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 | ≥1 |

Table 9.3.2.1.1-3 Fading test for single antenna (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 5 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.14 FDD according to Table A.4-1 for Category ≥ 2 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.15 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 9.3.2.1.1-4 Minimum requirement (FDD)

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

##### 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 | ≥1 |

#### 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) | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,18 | | | |
| 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 | ≥2 |

##### 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) | | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CRS reference signals | |  | Antenna ports 0, 1 | | | |
| CSI reference signals | |  | Antenna ports 15,…,22 | | | |
| 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 | ≥2 |

### 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 | ≥1 |

##### 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 | ≥1 |

#### 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 | ≥1 |

##### 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 | ≥1 |

#### 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 | ≥1 |

##### 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 | ≥1 |

### 9.3.5 Additional requirements for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

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

##### 9.3.5.1.1 FDD

For the parameters specified in Table 9.3.5.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.1.1-1 Fading test for single antenna (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| Bandwidth | MHz | 10 MHz | |
| Transmission mode |  | 1 (port 0) | |
| Cyclic Prefix |  | Normal | Normal |
| Cell ID |  | 0 | 1 |
| SINR (Note 8) | dB | -2 | N/A |
|  | dB[mW/15kHz] | -98 | N/A |
| Propagation channel |  | EPA5 | Static (Note 7) |
| Correlation and antenna configuration |  | Low (1 x 2) | (1 x 2) |
| DIP (Note 4) | dB | N/A | -0.41 |
| Reference measurement channel |  | Note 2 | R.2 FDD |
| Reporting mode |  | PUCCH 1-0 | N/A |
| Reporting periodicity | ms | *N*pd = 2 | N/A |
| CQI delay | ms | 8 | N/A |
| Physical channel for CQI reporting |  | PUSCH (Note 3) | N/A |
| PUCCH Report Type |  | 4 | N/A |
| *cqi-pmi-ConfigurationIndex* |  | 1 | N/A |
| Max number of HARQ transmissions |  | 1 | N/A |
| 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: 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 4: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.  Note 6: Both cells are time-synchronous.  Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 8: SINR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | |

Table 9.3.5.1.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| ** | 1.8 |
| UE Category | ≥1 |

##### 9.3.5.1.2 TDD

For the parameters specified in Table 9.3.5.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.1.2-1 Fading test for single antenna (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| Bandwidth | MHz | 10 MHz | |
| Transmission mode |  | 1 (port 0) | |
| Uplink downlink configuration |  | 2 | |
| Special subframe configuration |  | 4 | |
| Cyclic Prefix |  | Normal | Normal |
| Cell ID |  | 0 | 1 |
| SINR (Note 8) | dB | -2 | N/A |
|  | dB[mW/15kHz] | -98 | -98 |
| Propagation channel |  | EPA5 | Static (Note 7) |
| Correlation and antenna configuration |  | Low (1 x 2) | (1 x 2) |
| DIP (Note 4) | dB | N/A | -0.41 |
| Reference measurement channel |  | Note 2 | R.2A TDD |
| Reporting mode |  | PUCCH 1-0 | N/A |
| Reporting periodicity | ms | *N*pd = 5 | N/A |
| CQI delay | ms | 10 or 11 | N/A |
| Physical channel for CQI reporting |  | PUSCH (Note 3) | N/A |
| PUCCH Report Type |  | 4 | N/A |
| *cqi-pmi-ConfigurationIndex* |  | 3 | N/A |
| Max number of HARQ transmissions |  | 1 | N/A |
| ACK/NACK feedback mode |  | Multiplexing | N/A |
| 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: 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 4: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.  Note 6: Both cells are time-synchronous.  Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 8: SINR corresponds to  of Cell 1 as defined in clause 8.1.1. | | | |

Table 9.3.5.1.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| ** | 1.8 |
| UE Category | ≥1 |

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

##### 9.3.5.2.1 FDD

For the parameters specified in Table 9.3.5.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.1-1 Fading test for two antennas (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| Bandwidth | MHz | 10 MHz | |
| Transmission mode |  | 9 | |
| Cyclic Prefix |  | Normal | Normal |
| Cell ID |  | 0 | 1 |
| SINR (Note 8) | dB | -2 | N/A |
|  | dB[mW/15kHz] | -98 | N/A |
| Propagation channel |  | EPA5 | Static (Note 7) |
| Correlation and antenna configuration |  | Low (2 x 2) | (1 x 2) |
| Beamforming Model |  | As specified in Section B.4.3 (Note 10, 11) | N/A |
| DIP (Note 4) | dB | N/A | -0.41 |
| Cell-specific reference signals |  | Antenna ports 0,1 | Antenna port 0 |
| CSI reference signals |  | Antenna ports 15,16 | N/A |
| CSI-RS periodicity and subframe offset |  | 5/1 | N/A |
| CSI-RS reference signal configuration |  | 2 | N/A |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | Subframes / bitmap | N/A | 1 /  0010000000000000 |
| CodeBookSubsetRestriction bitmap |  | 001111 | N/A |
| Reference measurement channel |  | Note 2 | R.2 FDD |
| Reporting mode |  | PUCCH 1-1 | N/A |
| Reporting periodicity | ms | *N*pd = 5 | N/A |
| CQI delay | ms | 8 | N/A |
| Physical channel for CQI/PMI reporting |  | PUSCH (Note 3) | N/A |
| PUCCH Report Type for CQI/PMI |  | 2 | N/A |
| PUCCH channel for RI reporting |  | PUCCH Format 2 | N/A |
| PUCCH Report Type for RI |  | 3 | N/A |
| *cqi-pmi-ConfigurationIndex* |  | 2 | N/A |
| *ri-ConfigIndex* |  | 1 | N/A |
| Max number of HARQ transmissions |  | 1 | N/A |
| 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.11 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 subframe SF#0 and #5.  Note 4: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 6: Both cells are time-synchronous.  Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 8: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 9: N/A  Note 10: The precoder in clause B.4.3 follows UE recommended PMI.  Note 11: 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 9.3.5.2.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| ** | 1.8 |
| UE Category | ≥2 |

##### 9.3.5.2.2 TDD

For the parameters specified in Table 9.3.5.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.2-1: Fading test for single antenna (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
| Bandwidth | MHz | 10 MHz | |
| Transmission mode |  | 9 | |
| Uplink downlink configuration |  | 2 | |
| Special subframe configuration |  | 4 | |
| Cyclic Prefix |  | Normal | Normal |
| Cell ID |  | 0 | 1 |
| SINR (Note 8) | dB | -2 | N/A |
|  | dB[mW/15kHz] | -98 | -98 |
| Propagation channel |  | EPA5 | Static (Note 7) |
| Correlation and antenna configuration |  | Low (2 x 2) | (1 x 2) |
| Beamforming Model |  | As specified in Section B.4.3 (Note 11, 12) | N/A |
| DIP (Note 4) | dB | N/A | -0.41 |
| Cell-specific reference signals |  | Antenna ports 0,1 | Antenna port 0 |
| CSI reference signals |  | Antenna ports 15,16 | N/A |
| CSI-RS periodicity and subframe offset |  | 5/3 | N/A |
| CSI-RS reference signal configuration |  | 2 | N/A |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | Subframes / bitmap | N/A | 3 /  0010000000000000 |
| CodeBookSubsetRestriction bitmap |  | 001111 | N/A |
| Reference measurement channel |  | Note 2 | R.2A TDD |
| Reporting mode |  | PUCCH 1-1 | N/A |
| Reporting periodicity | ms | *N*pd = 5 | N/A |
| CQI delay | ms | 10 | N/A |
| Physical channel for CQI/PMI reporting |  | PUSCH (Note 3) | N/A |
| PUCCH Report Type for CQI/PMI |  | 2 | N/A |
| Physical channel for RI reporting |  | PUCCH Format 2 | N/A |
| PUCCH Report Type for RI |  | 3 | N/A |
| *cqi-pmi-ConfigurationIndex* |  | 3 | N/A |
| *ri-ConfigIndex* |  | 805 (Note 9) | N/A |
| Max number of HARQ transmissions |  | 1 | N/A |
| ACK/NACK feedback mode |  | Multiplexing | N/A |
| 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.11 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#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.  Note 4: The respective received power spectral density of each interfering cell relative to  is defined by its associated DIP value as specified in clause B.5.1.  Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  Note 6: Both cells are time-synchronous.  Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 8: SINR corresponds to  of Cell 1 as defined in clause 8.1.1.  Note 9: 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.  Note 10: N/A.  Note 11: The precoder in clause B.4.3 follows UE recommended PMI.  Note 12: 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 9.3.5.2.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| ** | 1.8 |
| UE Category | ≥2 |

### 9.3.6 Minimum requirement (With multiple CSI processes)

The purpose of the test is to verify the reporting accuracy of the CQI and the UE processing capability for multiple CSI processes. Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.3.6-1. For UE supports one CSI process, CSI process 2 is configured and the corresponding requirements shall be fulfilled. For UE supports three CSI processes, CSI processes 0, 1 and 2 are configured and the corresponding requirements shall be fulfilled. For UE supports four CSI processes, CSI processes 0, 1, 2 and 3 are configured and the corresponding requirements shall be fulfilled.

Table 9.3.6-1: Configuration of CSI processes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | CSI process 0 | CSI process 1 | CSI process 2 | CSI process 3 |
| CSI-RS resource | CSI-RS signal 0 | CSI-RS signal 1 | CSI-RS signal 0 | CSI-RS signal 1 |
| CSI-IM resource | CSI-IM resource 0 | CSI-IM resource 0 | CSI-IM resource 1 | CSI-IM resource 2 |

#### 9.3.6.1 FDD

For the parameters specified in Table 9.3.6.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.1-2 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 for CSI process 1, 2, or 3;

b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least **% of the time for CSI process 0;

c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.1-3;

d) 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 ≥ ;

e) 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 0.02.

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 9.3.6.1-1: Fading test for FDD

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | Test 2 | | | |
| TP1 | | TP2 | | TP1 | | TP2 | |
| Bandwidth | | MHz | 10 MHz | | | | 10 MHz | | | |
| Transmission mode | |  | 10 | | 10 | | 10 | | 10 | |
| Downlink power allocation |  | dB | 0 | | | | 0 | | | |
|  | dB | 0 | | | | 0 | | | |
|  | dB | -3 | | 0 | | -3 | | 0 | |
| σ | dB | -3 | | | | -3 | | | |
| SNR (Note 7) | | dB | 10 | 11 | 7 | 8 | 14 | 15 | 9 | 10 |
|  | | dB[mW/15kHz] | -88 | -87 | -91 | -90 | -84 | -85 | -89 | -88 |
|  | | dB[mW/15kHz] | -98 | | | | -98 | | | |
| Propagation channel | |  | EPA 5 Low | | Clause B.2.4.1 with **s, *a* = 1, Hz | | EPA 5 Low | | Clause B.2.4.1 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 4x2 | | 2x2 | | 4x2 | | 2x2 | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | | As specified in Section B.4.3 | | | |
| Timing offset between TPs | | us | 0 | | | | 0 | | | |
| Frequency offset between TPs | | Hz | 0 | | | | 0 | | | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | | | Antenna ports 0,1 | | | |
| CSI-RS signal 0 | |  | Antenna ports 15,…,18 | | N/A | | Antenna ports 15,…,18 | | N/A | |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | N/A | | 5/1 | | N/A | |
| CSI-RS 0 configuration | |  | 0 | | N/A | | 0 | | N/A | |
| CSI-RS signal 1 | |  | N/A | | Antenna ports 15,16 | | N/A | | Antenna ports 15,16 | |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | | 5/1 | | N/A | | 5/1 | |
| CSI-RS 1 configuration | |  | N/A | | 5 | | N/A | | 5 | |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | N/A | | 1 / 1110000000000000 | | N/A | | 1 / 1110000000000000 | |
| Zero-power CSI-RS 1 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 1 / 0010011000000000 | | N/A | | 1 / 0010011000000000 | | N/A | |
| CSI-IM 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | 5/1 | | 5/1 | | 5/1 | |
| CSI-IM 0 configuration | |  | 2 | | 2 | | 2 | | 2 | |
| CSI-IM 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | | N/A | | 5/1 | | N/A | |
| CSI-IM 1 configuration | |  | 6 | | N/A | | 6 | | N/A | |
| CSI-IM 2 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | | 5/1 | | N/A | | 5/1 | |
| CSI-IM 2 configuration | |  | N/A | | 1 | | N/A | | 1 | |
| CSI process 0 | CSI-RS |  | CSI-RS 0 | | | | CSI-RS 0 | | | |
| CSI-IM |  | CSI-IM 0 | | | | CSI-IM 0 | | | |
| Reporting mode |  | PUCCH 1-1 | | | | PUCCH 1-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 0x0000 0000 0000 0001 | | | | 0x0000 0000 0000 0001 | | | |
| Reporting periodicity | ms | *N*pd = 5 | | | | *N*pd = 5 | | | |
| CQI delay | ms | 11 | | | | 11 | | | |
| Physical channel for CQI/ PMI reporting |  | PUSCH (Note 6) | | | | PUSCH (Note 6) | | | |
| PUCCH Report Type for CQI/PMI |  | 2 | | | | 2 | | | |
| PUCCH channel for RI reporting |  | PUCCH Format 2 | | | | PUCCH Format 2 | | | |
| PUCCH report type for RI |  | 3 | | | | 3 | | | |
| *cqi-pmi-ConfigurationIndex* |  | 4 | | | | 4 | | | |
| *ri-ConfigIndex* |  | 2 | | | | 2 | | | |
| CSI process 1 | CSI-RS |  | CSI-RS 1 | | | | CSI-RS 1 | | | |
| CSI-IM |  | CSI-IM 0 | | | | CSI-IM 0 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 000001 | | | | 000001 | | | |
| Reporting interval (Note 10) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 11 | | | | 11 | | | |
| Sub-band size | RB | 6 (full size) | | | | 6 (full size) | | | |
| CSI process 2  (For UE configured single process) | CSI-RS |  | CSI-RS 0 | | | | CSI-RS 0 | | | |
| CSI-IM |  | CSI-IM 1 | | | | CSI-IM 1 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 0x0000 0000 0000 0001 | | | | 0x0000 0000 0000 0001 | | | |
| Reporting interval (Note 8) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 8 | | | | 8 | | | |
| Sub-band size | RB | 6 (full size) (Note 9) | | | | 6 (full size) (Note 9) | | | |
| CSI process 2  (For UE configured multiple processes) | CSI-RS |  | CSI-RS 0 | | | | CSI-RS 0 | | | |
| CSI-IM |  | CSI-IM 1 | | | | CSI-IM 1 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 0x0000 0000 0000 0001 | | | | 0x0000 0000 0000 0001 | | | |
| Reporting interval (Note 10) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 11 | | | | 11 | | | |
| Sub-band size | RB | 6 (full size) (Note 9) | | | | 6 (full size) (Note 9) | | | |
| CSI process 3 | CSI-RS |  | CSI-RS 1 | | | | CSI-RS 1 | | | |
| CSI-IM |  | CSI-IM 2 | | | | CSI-IM 2 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 000001 | | | | 000001 | | | |
| Reporting interval (Note 10) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 11 | | | | 11 | | | |
| Sub-band size | RB | 6 (full size) | | | | 6 (full size) | | | |
| CSI process for PDSCH scheduling | |  | CSI process 2 | | | | CSI process 2 | | | |
| Cell ID | |  | 0 | | 6 | | 0 | | 6 | |
| Quasi-co-located CSI-RS | |  | CSI-RS 0 | | CSI-RS 1 | | CSI-RS 0 | | CSI-RS 1 | |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | | Same Cell ID as Cell 2 | | Same Cell ID as Cell 1 | | Same Cell ID as Cell 2 | |
| PMI for subframe 2, 3, 4, 7, 8 and 9 | |  | 0x0000 0000 0000 0001 | | 100000 | | 0x0000 0000 0000 0001 | | 100000 | |
| PMI for subframe 1 and 6 | |  | 0x0000 0000 0001 0000 | | 100000 | | 0x0000 0000 0001 0000 | | 100000 | |
| Max number of HARQ transmissions | |  | 1 | | N/A | | 1 | | N/A | |
| 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: 3 symbols allocated to PDCCH  Note 3: Reference measurement channel RC.12 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.  Note 4: TM10 OCNG OP.8 FDD as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.  Note 5: TM10 OCNG OP.8 FDD as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2  Note 6: 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#2 and #7.  Note 7: 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 8: 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.  Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.  Note 10: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#2 and #7 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#1 and #6. | | | | | | | | | | |

Table 9.3.6.1-2: Minimum requirement (FDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | CSI process 0 | CSI process 1 | CSI process 2 | CSI process 3 |
| ** [%] | N/A | 2 | 2 | 2 |
| ** [%] | N/A | 40 | 40 | 40 |
| ** [%] | 10 | N/A | N/A | N/A |
| ** | N/A | N/A | 1.02 | N/A |
| UE Category | ≥1 | | | |

Table 9.3.6.1-3: Minimum median CQI difference between configured CSI processes (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | CSI process 1 | CSI process 2 | CSI process 3 |
| **CSI process 0** | N/A | 1 | 3 |
| UE Category | ≥1 | | |

#### 9.3.6.2 TDD

For the parameters specified in Table 9.3.6.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.2-2 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 for CSI process 1, 2, or 3;

b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least **% of the time for CSI process 0;

c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.2-3;

d) 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 ≥ ;

e) 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 0.02.

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 9.3.6.2-1: Fading test for TDD

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | | | Test 2 | | | |
| TP1 | | TP2 | | TP1 | | TP2 | |
| Bandwidth | | MHz | 10 MHz | | | | 10 MHz | | | |
| Transmission mode | |  | 10 | | 10 | | 10 | | 10 | |
| Uplink downlink configuration | |  | 2 | | 2 | | 2 | | 2 | |
| Special subframe configuration | |  | 4 | | 4 | | 4 | | 4 | |
| Downlink power allocation |  | dB | 0 | | | | 0 | | | |
|  | dB | 0 | | | | 0 | | | |
|  | dB | -3 | | 0 | | -3 | | 0 | |
| σ | dB | -3 | | | | -3 | | | |
| SNR (Note 7) | | dB | 10 | 11 | 7 | 8 | 14 | 15 | 9 | 10 |
|  | | dB[mW/15kHz] | -88 | -87 | -91 | -90 | -84 | -85 | -89 | -88 |
|  | | dB[mW/15kHz] | -98 | | | | -98 | | | |
| Propagation channel | |  | EPA 5 Low | | Clause B.2.4.1 with **s, *a* = 1, Hz | | EPA 5 Low | | Clause B.2.4.1 with **s, *a* = 1, Hz | |
| Antenna configuration | |  | 4x2 | | 2x2 | | 4x2 | | 2x2 | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | | As specified in Section B.4.3 | | | |
| Timing offset between TPs | | us | 0 | | | | 0 | | | |
| Frequency offset between TPs | | Hz | 0 | | | | 0 | | | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | | | | Antenna ports 0,1 | | | |
| CSI-RS signal 0 | |  | Antenna ports 15,…, 18 | | N/A | | Antenna ports 15,…, 18 | | N/A | |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | | N/A | | 5/3 | | N/A | |
| CSI-RS 0 configuration | |  | 0 | | N/A | | 0 | | N/A | |
| CSI-RS signal 1 | |  | N/A | | Antenna ports 15, 16 | | N/A | | Antenna ports 15, 16 | |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | | 5/3 | | N/A | | 5/3 | |
| CSI-RS 1 configuration | |  | N/A | | 5 | | N/A | | 5 | |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | N/A | | 3 / 1110000000000000 | | N/A | | 3 / 1110000000000000 | |
| Zero-power CSI-RS 1 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 / 0010011000000000 | | N/A | | 3 / 0010011000000000 | | N/A | |
| CSI-IM 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | | 5/3 | | 5/3 | | 5/3 | |
| CSI-IM 0 configuration | |  | 2 | | 2 | | 2 | | 2 | |
| CSI-IM 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | | N/A | | 5/3 | | N/A | |
| CSI-IM 1 configuration | |  | 6 | | N/A | | 6 | | N/A | |
| CSI-IM 2 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | | 5/3 | | N/A | | 5/3 | |
| CSI-IM 2 configuration | |  | N/A | | 1 | | N/A | | 1 | |
| CSI process 0 | CSI-RS |  | CSI-RS 0 | | | | CSI-RS 0 | | | |
| CSI-IM |  | CSI-IM 0 | | | | CSI-IM 0 | | | |
| Reporting mode |  | PUCCH 1-1 | | | | PUCCH 1-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 0x0000 0000 0000 0001 | | | | 0x0000 0000 0000 0001 | | | |
| Reporting periodicity | ms | *N*pd = 5 | | | | *N*pd = 5 | | | |
| CQI delay | ms | 12 | | | | 12 | | | |
| Physical channel for CQI/ PMI reporting |  | PUSCH (Note 6) | | | | PUSCH (Note 6) | | | |
| PUCCH Report Type for CQI/PMI |  | 2 | | | | 2 | | | |
| PUCCH channel for RI reporting |  | PUCCH Format 2 | | | | PUCCH Format 2 | | | |
| PUCCH report type for RI |  | 3 | | | | 3 | | | |
| *cqi-pmi-ConfigurationIndex* |  | 3 | | | | 3 | | | |
| *ri-ConfigIndex* |  | 805 (Note 10) | | | | 805 (Note 10) | | | |
| CSI process 1 | CSI-RS |  | CSI-RS 1 | | | | CSI-RS 1 | | | |
| CSI-IM |  | CSI-IM 0 | | | | CSI-IM 0 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 000001 | | | | 000001 | | | |
| Reporting interval (Note 9) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 12 | | | | 12 | | | |
| Sub-band size | RB | 6 (full size) | | | | 6 (full size) | | | |
| CSI process 2 | CSI-RS |  | CSI-RS 0 | | | | CSI-RS 0 | | | |
| CSI-IM |  | CSI-IM 1 | | | | CSI-IM 1 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 0x0000 0000 0000 0001 | | | | 0x0000 0000 0000 0001 | | | |
| Reporting interval (Note 9) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 12 | | | | 12 | | | |
| Sub-band size | RB | 6 (full size) (Note 8) | | | | 6 (full size) (Note 8) | | | |
| CSI process 3 | CSI-RS |  | CSI-RS 1 | | | | CSI-RS 1 | | | |
| CSI-IM |  | CSI-IM 2 | | | | CSI-IM 2 | | | |
| Reporting mode |  | PUSCH 3-1 | | | | PUSCH 3-1 | | | |
| CodeBookSubsetRestriction bitmap |  | 000001 | | | | 000001 | | | |
| Reporting interval (Note 9) | ms | 5 | | | | 5 | | | |
| CQI delay | ms | 12 | | | | 12 | | | |
| Sub-band size | RB | 6 (full size) | | | | 6 (full size) | | | |
| CSI process for PDSCH scheduling | |  | CSI process 2 | | | | CSI process 2 | | | |
| Cell ID | |  | 0 | | 6 | | 0 | | 6 | |
| Quasi-co-located CSI-RS | |  | CSI-RS 0 | | CSI-RS 1 | | CSI-RS 0 | | CSI-RS 1 | |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | | Same Cell ID as Cell 2 | | Same Cell ID as Cell 1 | | Same Cell ID as Cell 2 | |
| PMI for subframe 4 and 9 | |  | 0x0000 0000 0000 0001 | | 100000 | | 0x0000 0000 0000 0001 | | 100000 | |
| PMI for subframe 3 and 8 | |  | 0x0000 0000 0001 0000 | | 100000 | | 0x0000 0000 0001 0000 | | 100000 | |
| Max number of HARQ transmissions | |  | 1 | | N/A | | 1 | | N/A | |
| ACK/NACK feedback mode | |  | Multiplexing | | N/A | | Multiplexing | | N/A | |
| 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: 3 symbols allocated to PDCCH  Note 3: Reference measurement channel RC.12 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.  Note 4: TM10 OCNG OP.8 TDD is transmitted as specified in A.5.2.8 on subframe 3 and 8 from TP1.  Note 5: TM10 OCNG OP.8 TDD is transmitted as specified in A.5.2.8 on subframe 3, 4, 8 and 9 from TP2  Note 6: 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 7: 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 8: 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 in uplink SF#7 and #2.  Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.  Note 10: 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 9.3.6.2-2: Minimum requirement (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | CSI process 0 | CSI process 1 | CSI process 2 | CSI process 3 |
| ** [%] | N/A | 2 | 2 | 2 |
| ** [%] | N/A | 40 | 40 | 40 |
| ** [%] | 10 | N/A | N/A | N/A |
| ** | N/A | N/A | 1.02 | N/A |
| UE Category | ≥1 | | | |

Table 9.3.6.2-3: Minimum median CQI difference between configured CSI processes (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | CSI process 1 | CSI process 2 | CSI process 3 |
| **CSI process 0** | N/A | 1 | 3 |
| UE Category | ≥1 | | |

### 9.3.7 Minimum requirement PUSCH 3-2

#### 9.3.7.1 FDD

For the parameters specified in Table 9.3.7.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.1-2 and by the following.

a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be ≥**

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 based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be ≥**

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 FDD for test 1 and according to RC.18 FDD for test 2.

Table 9.3.7.1-1 Sub-band test for FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10MHz | | | |
| PDSCH resource allocation | | RB | 50PRB | | a subband, 6PRB | |
| Transmission mode | |  | TM6 | | TM9 | |
| Downlink power allocation |  | dB | -6 | | 0 | |
|  | dB | -6 | | 0 | |
|  | dB | - | | -3 | |
| σ | dB | 3 | | -3 | |
| SNR (Note 3) | | dB | 0 | 1 | 5 | 6 |
|  | | dB[mW/15kHz] | -98 | -97 | -93 | -92 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 | -98 |
| Propagation channel | |  | EVA5 | | EVA5 | |
| Antenna configuration | |  | 4x2 ULA low | | 4x2 XP high (Note 4) | |
| Beamforming Model | |  | - | | B.4.3 | |
| CRS reference signals | |  | Antenna ports 0, 1, 2, 3 | | Antenna ports 0, 1 | |
| Time offset between TX antenna (Note 5) | | ns | 65 | | - | |
| CSI reference signals | |  |  | | Antenna ports 15, 16, 17, 18 | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | - | | 5/ 1 | |
| CSI-RS reference signal configuration | |  | - | | 4 | |
| alternativeCodebookEnabledFor4TX | |  | No | | Yes | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 FFFF | | 0x0000 0000 0000 FFFF 0000 FFFF | |
| Reporting interval (Note 6) | | ms | 5 | | 5 | |
| CQI delay | | ms | 8 | | 8 | |
| Reporting mode | |  | PUSCH 3-2, PUSCH 3-1 | | PUSCH 3-2, PUSCH 1-2 | |
| Sub-band size | | RB | 6 (full size) | | 6 (full size) | |
| Max number of HARQ transmissions | |  | 1 | | 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.17 FDD / RC.18 FDD for Test 1 / 2 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: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.  Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.  Note 6: 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 9.3.7.1-2 Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| α | 1.05 | - |
| β | - | 1.15 |
| UE Category | ≥2 | ≥2 |

#### 9.3.7.2 TDD

For the parameters specified in Table 9.3.7.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.2-2 and by the following.

a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be ≥**

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 based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be ≥**

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 TDD for test 1 and RC.18 TDD for test 2.

Table 9.3.7.2-1 Sub-band test for TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | MHz | 10MHz | | | |
| PDSCH resource allocation | | RB | 50PRB | | a subband, 6PRB | |
| Transmission mode | |  | TM6 | | TM9 | |
| Uplink downlink configuration | |  | 1 | | 1 | |
| Special subframe configuration | |  | 4 | | 4 | |
| Downlink power allocation |  | dB | -6 | | 0 | |
|  | dB | -6 | | 0 | |
|  | dB | - | | -3 | |
| σ | dB | 3 | | -3 | |
| SNR (Note 3) | | dB | 0 | 1 | 5 | 6 |
|  | | dB[mW/15kHz] | -98 | -97 | -93 | -92 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 | -98 |
| Propagation channel | |  | EVA5 | | EVA5 | |
| Antenna configuration | |  | 4x2 ULA low | | 4x2 XP high (Note 4) | |
| Beamforming Model | |  | - | | B.4.3 | |
| CRS reference signals | |  | Antenna ports 0, 1, 2, 3 | | Antenna ports 0, 1 | |
| Time offset between TX antenna (Note 5) | | ns | 65 | | - | |
| CSI reference signals | |  |  | | Antenna ports 15, 16, 17, 18 | |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | - | | 5/ 4 | |
| CSI-RS reference signal configuration | |  | - | | 4 | |
| alternativeCodebookEnabledFor4TX | |  | No | | Yes | |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 FFFF | | 0x0000 0000 0000 FFFF 0000 FFFF | |
| Reporting interval (Note 6) | | ms | 5 | | 5 | |
| CQI delay | | ms | 8 | | 8 | |
| Reporting mode | |  | PUSCH 3-2, PUSCH 3-1 | | PUSCH 3-2, PUSCH 1-2 | |
| Sub-band size | | RB | 6 (full size) | | 6 (full size) | |
| Max number of HARQ transmissions | |  | 1 | | 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.17 TDD / RC.18 TDD for Test 1 / 2 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: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.  Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.  Note 6: 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 in uplink SF#3 and #8. | | | | | | |

Table 9.3.7.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| α | 1.05 | - |
| β | - | 1.15 |
| UE Category | ≥2 | ≥2 |

### 9.3.8 Additional requirements for enhanced receiver Type B

The purpose of the test is to verify that the reporting of the channel quality based on the receiver of the enhanced Type B meets a minimum performance. Performance requirements are specified in terms of the relative throughput obtained when the transport format is that indicated by the reported CQI with NeighCellsInfo-r12 configured compared to the case without NeighCellsInfo-r12 configured. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the interference cells.

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

##### 9.3.8.1.1 FDD

For the parameters specified in Table 9.3.8.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with NeighCellsInfo-r12 configured and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources without NeighCellsInfo-r12 configured shall be ≥ **;

Table 9.3.8.1.1-1 Fading test for FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Bandwidth | | | MHz | 10 | | |
| Transmission mode | | |  | 4 | | |
| Downlink power allocation | |  | dB | -3 | | |
|  | dB | -3 | | |
| σ | dB | 0 | | |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell ID | | |  | 0 | 1 | 6 |
| SNR | | | dB | 8.34 | N/A | N/A |
|  | | |  | N/A | 3.28 | 0.74 |
|  | | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 |
|  | | | dB  [mW/15kHz] | -98 | | |
| Propagation channel | | |  | EPA5 | EPA5 | EPA5 |
| Correlation and antenna configuration | | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| Interference model | | |  | N/A | As specified in clause B.6.3 | As specified in clause B.6.3 |
| Reporting periodicity | | | ms | *N*pd = 5 | N/A | N/A |
| Physical channel for CQI/PMI reporting | | |  | PUCCH Format 2 | N/A | N/A |
| PUCCH Report Type for CQI/PMI | | |  | 2 | N/A | N/A |
| PUCCH Report Type for RI | | |  | 3 | N/A | N/A |
| *cqi-pmi-ConfigurationIndex* | | |  | 6 | N/A | N/A |
| *ri-ConfigurationIndex* | | |  | 1 | N/A | N/A |
| *CodeBookSubsetRestriction bitmap* | | |  | 000001 | N/A | N/A |
| Max number of HARQ transmissions | | |  | 1 | N/A | N/A |
| NeighCellsInfo-r12 (Note 4) | p-aList-r12 | |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 | |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| 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.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: All cells are time-synchronous.  Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 9.3.8.1.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

##### 9.3.8.1.2 TDD

For the parameters specified in Table 9.3.8.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with NeighCellsInfo-r12 configured and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources without NeighCellsInfo-r12 configured shall be ≥ **;

Table 9.3.8.1.2-1 Fading test for TDD

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Bandwidth | | MHz | 10 | | |
| Transmission mode | |  | 4 | | |
| Uplink downlink configuration | |  | 2 | | |
| Special subframe configuration | |  | 4 | | |
| Downlink power allocation |  | dB | -3 | | |
|  | dB | -3 | | |
| σ | dB | 0 | | |
| Cyclic Prefix | |  | Normal | Normal | Normal |
| Cell ID | |  | 0 | 1 | 6 |
| SNR | | dB | 8.34 | N/A | N/A |
|  | |  | N/A | 3.28 | 0.74 |
|  | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 |
|  | | dB  [mW/15kHz] | -98 | | |
| Propagation channel | |  | EPA5 | EPA5 | EPA5 |
| Correlation and antenna configuration | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| Interference model | |  | N/A | As specified in clause B.6.3 | As specified in clause B.6.3 |
| Reporting periodicity | | ms | *N*pd = 5 | N/A | N/A |
| Physical channel for CQI/PMI reporting | |  | PUSCH  (Note 3) | N/A | N/A |
| PUCCH Report Type | |  | 2 | N/A | N/A |
| *cqi-pmi-ConfigurationIndex* | |  | 3 | N/A | N/A |
| *ri-ConfigIndex* | |  | 805 (Note 5) | N/A | N/A |
| *CodeBookSubsetRestriction bitmap* | |  | 000001 | N/A | N/A |
| Max number of HARQ transmissions | |  | 1 | N/A | N/A |
| ACK/NACK feedback mode | |  | Multiplexing | N/A | N/A |
| NeighCellsInfo-r12 (Note 6) | p-aList-r12 |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| 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.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: 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 4: All cells are time-synchronous.  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.  Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | |

Table 9.3.8.1.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

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

##### 9.3.8.2.1 FDD

For the parameters specified in Table 9.3.8.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with NeighCellsInfo-r12 configured and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources without NeighCellsInfo-r12 configured shall be ≥ **;

Table 9.3.8.2.1-1 Fading test for FDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Bandwidth | | | MHz | 10 | | |
| Transmission mode | | |  | 9 | | |
| Downlink power allocation |  | | dB | 0 | | |
|  | | dB | 0 | | |
| Pc | | dB | 0 | | |
| σ | | dB | 0 | | |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell ID | | |  | 0 | 1 | 6 |
| SNR | | | dB | 8.34 | N/A | N/A |
|  | | |  | N/A | 3.28 | 0.74 |
|  | | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 |
|  | | | dB  [mW/15kHz] | -98 | | |
| Propagation channel | | |  | EPA5 | EPA5 | EPA5 |
| Correlation and antenna configuration | | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| Beamforming Model | | |  | As specified in Section B.4.3 | | |
| CSI reference signals | | |  | Antenna ports 15,16 | N/A | N/A |
| CSI-RS periodicity and subframe offset | | |  | 5/1 | N/A | N/A |
| CSI-RS reference signal configuration | | |  | 2 | N/A | N/A |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | N/A | 1 /  0001000000000000 | 1 /  0001000000000000 |
| CodeBookSubsetRestriction bitmap | | |  | 000001 | N/A | N/A |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Reporting periodicity | | | ms | *N*pd = 5 | N/A | N/A |
| Physical channel for CQI/PMI reporting | | |  | PUSCH (Note 3) | N/A | N/A |
| PUCCH Report Type for CQI/PMI | | |  | 2 | N/A | N/A |
| PUCCH channel for RI reporting | | |  | PUCCH Format 2 | N/A | N/A |
| PUCCH Report Type for RI | | |  | 3 | N/A | N/A |
| *cqi-pmi-ConfigurationIndex* | | |  | 2 | N/A | N/A |
| *ri-ConfigIndex* | | |  | 1 | N/A | N/A |
| Max number of HARQ transmissions | | |  | 1 | N/A | N/A |
| NeighCellsInfo-r12 (Note 5) | | p-aList-r12 |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| 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.11 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 subframe SF#0 and #5.  Note 4: All cells are time-synchronous.  Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 9.3.8.2.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

##### 9.3.8.2.2 TDD

For the parameters specified in Table 9.3.8.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with NeighCellsInfo-r12 configured and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources without NeighCellsInfo-r12 configured shall be ≥ **;

Table 9.3.8.2.2-1 Fading test for TDD

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Cell 1 | Cell 2 | Cell 3 |
| Bandwidth | | | MHz | 10 | | |
| Transmission mode | | |  | 9 | | |
| Downlink power allocation |  | | dB | 0 | | |
|  | | dB | 0 | | |
| Pc | | dB | 0 | | |
| σ | | dB | 0 | | |
| Uplink downlink configuration | | |  | 2 | | |
| Special subframe configuration | | |  | 4 | | |
| Cyclic Prefix | | |  | Normal | Normal | Normal |
| Cell ID | | |  | 0 | 1 | 6 |
| SNR | | | dB | 8.34 | N/A | N/A |
|  | | |  | N/A | 3.28 | 0.74 |
|  | | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 |
|  | | | dB  [mW/15kHz] | -98 | | |
| Propagation channel | | |  | EPA5 | EPA5 | EPA5 |
| Correlation and antenna configuration | | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 |
| Cell-specific reference signals | | |  | Antenna ports 0,1 | Antenna ports 0,1 | Antenna ports 0,1 |
| Beamforming Model | | |  | As specified in Section B.4.3 | | |
| CSI reference signals | | |  | Antenna ports 15,16 | N/A | N/A |
| CSI-RS periodicity and subframe offset | | |  | 5/3 | N/A | N/A |
| CSI-RS reference signal configuration | | |  | 2 | N/A | N/A |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | | Subframes / bitmap | N/A | 3 /  0001000000000000 | 3 /  0001000000000000 |
| CodeBookSubsetRestriction bitmap | | |  | 000001 | N/A | N/A |
| Interference model | | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 |
| Reporting periodicity | | | ms | *N*pd = 5 | N/A | N/A |
| Physical channel for CQI/PMI reporting | | |  | PUSCH (Note 3) | N/A | N/A |
| PUCCH Report Type for CQI/PMI | | |  | 2 | N/A | N/A |
| Physical channel for RI reporting | | |  | PUCCH Format 2 | N/A | N/A |
| PUCCH Report Type for RI | | |  | 3 | N/A | N/A |
| *cqi-pmi-ConfigurationIndex* | | |  | 3 | N/A | N/A |
| *ri-ConfigIndex* | | |  | 805 (Note 5) | N/A | N/A |
| Max number of HARQ transmissions | | |  | 1 | N/A | N/A |
| ACK/NACK feedback mode | | |  | Multiplexing | N/A | N/A |
| NeighCellsInfo-r12 (Note 6) | | p-aList-r12 |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} |
| transmissionModeList-r12 |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} |
| 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.11 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#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.  Note 4: All cells are time-synchronous.  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.  Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 9.3.8.2.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

#### 9.3.8.3 Minimum requirement with CSI process

##### 9.3.8.3.1 FDD

For the parameters specified in Table 9.3.8.3.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.1-2 and by the following

a) the ratio of the throughput obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified  and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified  shall be ≥ **;

Table 9.3.8.3.1-1 Fading test for single antenna (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 | |
| Bandwidth | | MHz | 10 | | | |
| Transmission mode | |  | 10 | 9 | | 9 |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| Pc | dB | 0 | | | |
| σ | dB | 0 | | | |
| Cyclic Prefix | |  | Normal | Normal | Normal | |
| Cell ID | |  | 0 | 1 | 6 | |
| SNR | | dB | 8.34 | N/A | N/A | |
|  | | dB | N/A | 3.28 | 0.74 | |
|  | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 | |
|  | | dB[mW/15kHz] | -98 | | | |
| Propagation channel | |  | EPA5 | EPA5 | EPA5 | |
| Correlation and antenna configuration | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna port 0, 1 | Antenna port 0, 1 | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CSI reference signals | |  | Antenna ports 15,16 | N/A | N/A | |
| CSI-RS periodicity and subframe offset | |  | 5/1 | N/A | N/A | |
| CSI-RS reference signal configuration | |  | 2 | N/A | N/A | |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | N/A | 1 /  0001000000000000 | 1 /  0001000000000000 | |
| Interference model | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 | |
| CSI process | CSI-RS |  | CSI-RS | N/A | N/A | |
| CSI-IM |  | CSI-IM | N/A | N/A | |
| Reporting mode |  | PUCCH 1-1 | N/A | N/A | |
| CodeBookSubsetRestriction bitmap |  | 000001 | N/A | N/A | |
| Reporting periodicity | ms | *N*pd = 5 | N/A | N/A | |
| CQI delay | ms | 8 | N/A | N/A | |
| Physical channel for CQI/ PMI reporting |  | PUSCH  (Note 3) | N/A | N/A | |
| PUCCH Report Type for CQI/PMI |  | 2 | N/A | N/A | |
| PUCCH channel for RI reporting |  | PUCCH Format 2 | N/A | N/A | |
| PUCCH report type for RI |  | 3 | N/A | N/A | |
| *cqi-pmi-ConfigurationIndex* |  | 2 | N/A | N/A | |
| *ri-ConfigIndex* |  | 1 | N/A | N/A | |
| CSI-IM periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | N/A | N/A | |
| CSI-IM configuration | |  | 6 | N/A | N/A | |
| CSI process for PDSCH scheduling | |  | CSI process | N/A | N/A | |
| Quasi-co-located CSI-RS | |  | CSI-RS | N/A | N/A | |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | N/A | N/A | |
| Reference measurement channel | |  | Note 2 | N/A | N/A | |
| Max number of HARQ transmissions | |  | 1 | N/A | N/A | |
| NeighCellsInfo-r12 (Note 5) | p-aList-r12 |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} | |
| transmissionModeList-r12 |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} | |
| 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.11 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 subframe SF#0 and #5.  Note 4: All cells are time-synchronous.  Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 9.3.8.3.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

##### 9.3.8.3.2 TDD

For the parameters specified in Table 9.3.8.3.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.2-2 and by the following

a) the ratio of the throughput obtained obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified  and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified  shall be ≥ **;

Table 9.3.8.3.2-1 Fading test for single antenna (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 | Cell 3 | |
| Bandwidth | | MHz | 10 | | | |
| Transmission mode | |  | 10 | 9 | | 9 |
| Downlink power allocation |  | dB | 0 | | | |
|  | dB | 0 | | | |
| Pc | dB | 0 | | | |
| σ | dB | 0 | | | |
| Uplink downlink configuration | |  | 2 | | | |
| Special subframe configuration | |  | 4 | | | |
| Cyclic Prefix | |  | Normal | Normal | Normal | |
| Cell ID | |  | 0 | 1 | 6 | |
| SNR | | dB | 8.34 | N/A | N/A | |
|  | | dB | N/A | 3.28 | 0.74 | |
|  | | dB  [mW/15kHz] | -89.66 | -94.72 | -97.26 | |
|  | | dB[mW/15kHz] | -98 | | | |
| Propagation channel | |  | EPA5 | EPA5 | EPA5 | |
| Correlation and antenna configuration | |  | Low 2 x 2 | Low 2 x 2 | Low 2 x 2 | |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna port 0,1 | Antenna port 0,1 | |
| Beamforming Model | |  | As specified in Section B.4.3 | | | |
| CSI reference signals | |  | Antenna ports 15,16 | N/A | N/A | |
| CSI-RS periodicity and subframe offset | |  | 5/3 | N/A | N/A | |
| CSI-RS reference signal configuration | |  | 2 | N/A | N/A | |
| Zero-power CSI-RS configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | | Subframes / bitmap | N/A | 3 /  0001000000000000 | 3 /  0001000000000000 | |
| Interference model | |  | N/A | As specified in clause B.6.4 | As specified in clause B.6.4 | |
| CSI process | CSI-RS |  | CSI-RS | N/A | N/A | |
| CSI-IM |  | CSI-IM | N/A | N/A | |
| Reporting mode |  | PUCCH 1-1 | N/A | N/A | |
| CodeBookSubsetRestriction bitmap |  | 000001 | N/A | N/A | |
| Reporting periodicity | ms | *N*pd = 5 | N/A | N/A | |
| CQI delay | ms | 8 | N/A | N/A | |
| Physical channel for CQI/ PMI reporting |  | PUSCH  (Note 3) | N/A | N/A | |
| PUCCH Report Type for CQI/PMI |  | 2 | N/A | N/A | |
| PUCCH channel for RI reporting |  | PUCCH Format 2 | N/A | N/A | |
| PUCCH report type for RI |  | 3 | N/A | N/A | |
| *cqi-pmi-ConfigurationIndex* |  | 3 | N/A | N/A | |
| *ri-ConfigIndex* |  | 805 (Note 5) | N/A | N/A | |
| CSI-IM periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | N/A | N/A | |
| CSI-IM configuration | |  | 6 | N/A | N/A | |
| CSI process for PDSCH scheduling | |  | CSI process | N/A | N/A | |
| Quasi-co-located CSI-RS | |  | CSI-RS | N/A | N/A | |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | N/A | N/A | |
| Reference measurement channel | |  | Note 2 | N/A | N/A | |
| Max number of HARQ transmissions | |  | 1 | N/A | N/A | |
| ACK/NACK feedback mode | |  | Multiplexing | N/A | N/A | |
| NeighCellsInfo-r12 (Note 6) | p-aList-r12 |  | N/A | {dB-6, dB-3, dB0} | {dB-6, dB-3, dB0} | |
| transmissionModeList-r12 |  | N/A | {2,3,4,8,9} | {2,3,4,8,9} | |
| 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.11 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#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.  Note 4: All cells are time-synchronous.  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.  Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. | | | | | | |

Table 9.3.8.3.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | Test |
| ** | 0.925 |
| UE Category | ≥2 |

## 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 and transmission mode 9 with 4TX enhanced codebook are specified in terms of the ratio



In the definition of *γ*, for PUSCH 3-1 single PMI, PUCCH 1-1 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 |

##### 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 |

#### 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 |

##### 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 |

#### 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 |

##### 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 |
| OCNG Pattern | |  | OP.7 TDD for UE Category 1, and OP.1 TDD for UE Category ≥2 |
| 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 |

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

##### 9.4.1.4.1 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.1-2.

Table 9.4.1.4.1-1 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 | |  | High XP 4 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| 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 0000 00FF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUCCH 1-1 submode1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 10 |
| 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 |
| *cqi-pmi-ConfigurationIndex* | |  | 4 |
| *ri-ConfigIndex* | |  | 1 |
| Measurement channel | |  | R.60 FDD |
| OCNG Pattern | |  | OP.1 FDD |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| alternativeCodeBookEnabledFor4TX-r12 | |  | True |
| 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: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.  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.  Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4 | | | |

Table 9.4.1.4.1-2 Minimum requirement (FDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.8 |
| UE Category | ≥1 |

##### 9.4.1.4.2 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.2-2.

Table 9.4.1.4.2-1 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 | |  | EPA5 |
| Precoding granularity | | PRB | 50 |
| Correlation and antenna configuration | |  | High XP 4 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| CSI-RS periodicity and subframe offset  *T*CSI-RS / *∆*CSI-RS | |  | 5/ 4 |
| CSI-RS reference signal configuration | |  | 6 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 0000 FFFF 0000 00FF |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUCCH 1-1 submode1 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 15 |
| 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 |
| *cqi-pmi-ConfigurationIndex* | |  | 4 |
| *ri-ConfigIndex* | |  | 1 |
| Measurement channel | |  | R.60 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 |
| alternativeCodeBookEnabledFor4TX-r12 | |  | True |
| 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: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.  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 9.4.1.4.2-2 Minimum requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.8 |
| UE Category | ≥1 |

### 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 |
| 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 |

##### 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 |
| 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 |

#### 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 |

##### 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 |

#### 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 |
| OCNG Pattern | |  | OP.7 FDD for UE Category 1  OP.1 FDD for UE Category ≥2 |
| 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 |

##### 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 |
| OCNG Pattern | |  | OP.7 TDD for UE Category 1  OP.1 TDD for UE Category ≥2 |
| 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: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be used.  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 |

##### 9.4.2.3.3 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.3-2.

Table 9.4.2.3.3-1 PMI test for dual-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 | |  | High XP 4 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| CSI-RS periodicity and subframe offset  ***T*CSI-RS / *I*CSI-RS** | |  | 5/ 1 |
| CSI-RS reference signal configuration | |  | 8 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 FFFF 0000 FFFF 0000 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH1-2 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 8 |
| Measurement channel | |  | R.45-1 FDD for UE Category 1, R.45 FDD for UE Category ≥2 |
| Rank Number of PDSCH | |  | 2 |
| OCNG Pattern | |  | OP.7 FDD for UE Category 1  OP.1 FDD for UE Category ≥2 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| alternativeCodeBookEnabledFor4TX-r12 | |  | True |
| 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: 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.  Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4 | | | |

Table 9.4.2.3.3-2 Minimum requirement (FDD)

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

##### 9.4.2.3.4 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.4-2.

Table 9.4.2.3.4-1 PMI test for dual-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 |
| Correlation and antenna configuration | |  | XP High 4 x 2 |
| Beamforming model | |  | Annex B.4.3 |
| Cell-specific reference signals | |  | Antenna ports 0,1 |
| CSI reference signals | |  | Antenna ports  15,…,18 |
| CSI-RS periodicity and subframe offset  ***T*CSI-RS / *I*CSI-RS** | |  | 5/ 4 |
| CSI-RS reference signal configuration | |  | 4 |
| CodeBookSubsetRestriction bitmap | |  | 0x0000 0000 FFFF 0000 FFFF 0000 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 |
| Pc | dB | -3 |
| σ | dB | -3 |
|  | | dB[mW/15kHz] | -98 |
| Reporting mode | |  | PUSCH1-2 |
| Reporting interval | | ms | 5 |
| PMI delay (Note 2) | | ms | 10 |
| Measurement channel | |  | R.61-1 TDD for UE Category 1, R.61 TDD for UE Category ≥2 |
| Rank Number of PDSCH | |  | 2 |
| OCNG Pattern | |  | OP.7 FDD for UE Category 1  OP.1 FDD for UE Category ≥2 |
| Max number of HARQ transmissions | |  | 4 |
| Redundancy version coding sequence | |  | {0,1,2,3} |
| ACK/NACK feedback mode | |  | Multiplexing |
| alternativeCodeBookEnabledFor4TX-r12 | |  | True |
| 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).  Note3: 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 9.4.2.3.4-2 Minimum requirement (TDD)

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

### 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, and transmission mode 10 is used with the specified CodebookSubSetRestriction in section 9.5.5.

For fixed rank 1 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission in sections 9.5.1, 9.5.2 and 9.5.5, 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 |
| 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 (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 |
| **2 | 1 | N/A | N/A |
| UE Category | ≥2 | ≥2 | ≥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 |
| 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 | |  | 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 |
| **2 | 1 | N/A | N/A |
| UE Category | ≥2 | ≥2 | ≥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 | | |
| Beamforming Model | |  | As specified in Section B.4.3 | | |
| CSI reference signals | |  | Antenna ports 15, 16 | | |
| 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 | ≥2 | ≥2 |

#### 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 | ≥2 | ≥2 |

### 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 | *Npd*= 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 in Cell 1 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: 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].  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 | ≥2 |

#### 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 | | | Test2 | | |
| 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 in Cell 1 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: 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#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #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].  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 | ≥2 |

### 9.5.4 Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)

#### 9.5.4.1 FDD

For the parameters specified in Table 9.5.4.1-1, the minimum performance requirement in Table 9.5.4.1-2 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;

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 ≥ ;

In Table 9.5.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.1-1: RI Test (FDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Bandwidth | | | MHz | | 10 | | 10 | | 10 | |
| PDSCH transmission mode | | |  | | 3 | | As defined in Note 1 | | As defined in Note 1 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 | | -3 | | -3 | |
| σ | dB | | 0 | | N/A | | N/A | |
| Propagation condition and antenna configuration | | |  | | 2×2 EPA5 (Note 2) | | 2×2 EPA5 (Note 2) | | 2×2 EPA5 (Note 2) | |
| CodeBookSubsetRestriction bitmap | | |  | | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | | As defined in Note 1 | | As defined in Note 1 | |
| at antenna port | |  | dB[mW/15kHz] | | -98 (Note 3) | | N/A | | N/A | |
|  | dB[mW/15kHz] | | -98 (Note 4) | | N/A | | N/A | |
|  | dB[mW/15kHz] | | -93 (Note 5) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 9.5.4.1-2 for each test | | 12 | | 10 | |
|  | | | dB[mW/15kHz] | | Reference Value in Table 9.5.4.1-2 for each test | | -86 | | -88 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 6) | | |  | | N/A | | 10000000  10000000  10000000  10000000  10000000 | | 10000000  10000000  10000000  10000000  10000000 | |
| RLM/RRM Measurement Subframe Pattern (Note 7) | | |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | |
| CSI Subframe Sets (Note 8) | | CCSI,0 |  | | 10000000  10000000  10000000  10000000  10000000 | | N/A | | N/A | |
| CCSI,1 |  | | 01111111 01111111 01111111 01111111 01111111 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 3 | | Note 9 | | Note 9 | |
| Maximum number of HARQ transmissions | | |  | | 1 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-0 | | N/A | | N/A | |
| Physical channel for CQI reporting | | |  | | PUCCH format 2 | | N/A | | N/A | |
| PUCCH Report Type for CQI | | |  | | 4 | | N/A | | N/A | |
| Physical channel for RI reporting | | |  | | PUCCH Format 2 | | N/A | | N/A | |
| PUCCH Report Type for RI | | |  | | 3 | | N/A | | N/A | |
| Reporting periodicity | | | ms | | *Npd*= 10 | | N/A | | N/A | |
| *cqi-pmi-ConfigurationIndex* | | |  | | 11 | | N/A | | N/A | |
| *ri-ConfigurationInd* | | |  | | 5 | | N/A | | N/A | |
| *cqi-pmi-ConfigurationIndex2* | | |  | | 10 | | N/A | | N/A | |
| *ri-ConfigurationInd2* | | |  | | 2 | | N/A | | N/A | |
| Cyclic prefix | | |  | | Normal | | Normal | | Normal | |
| Note 1: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern OP.5 FDD as defined in Annex A.5.1.5.  Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  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: The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by “0” of ABS pattern.  Note 10: 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 11: Reference measurement channel in Cell 1 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 12: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.  Note 13: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test. | | | | | | | | | | |

Table 9.5.4.1-2: Minimum requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** |
| for Cell 1 (dB) | 4 | 20 | 20 |
| for Cell 1 (dB[mW/15kHz]) | -94 | -78 | -78 |
| Antenna correlation | High for Cell 1, low for Cell 2 and Cell 3 | Low for Cell 1, Cell 2 and Cell 3 | High for Cell 1, low for Cell 2 and Cell 3 |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1.05 | N/A | N/A |
| UE Category | ≥2 | ≥2 | ≥2 |

#### 9.5.4.2 TDD

For the parameters specified in Table 9.5.4.2-1, the minimum performance requirement in Table 9.5.4.2-2 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;

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 ≥ ;

In Table 9.5.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.2-1: RI Test (TDD)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Cell 1 | | Cell 2 | | Cell 3 | |
| Bandwidth | | | MHz | | 10 | | 10 | | 10 | |
| PDSCH transmission mode | | |  | | 3 | | As defined in Note 1 | | As defined in Note 1 | |
| Uplink downlink configuration | | |  | | 1 | | 1 | | 1 | |
| Special subframe configuration | | |  | | 4 | | 4 | | 4 | |
| Downlink power allocation | |  | dB | | -3 | | -3 | | -3 | |
|  | dB | | -3 | | -3 | | -3 | |
| σ | dB | | 0 | | N/A | | N/A | |
| Propagation condition and antenna configuration | | |  | | 2×2 EPA5 (Note 2) | | 2×2 EPA5 (Note 2) | | 2×2 EPA5 (Note 2) | |
| CodeBookSubsetRestriction bitmap | | |  | | 01 for fixed RI = 1  10 for fixed RI = 2  11 for UE reported RI | | As defined in Note 1 | | As defined in Note 1 | |
| at antenna port | |  | dB[mW/15kHz] | | -98 (Note 3) | | N/A | | N/A | |
|  | dB[mW/15kHz] | | -98 (Note 4) | | N/A | | N/A | |
|  | dB[mW/15kHz] | | -93 (Note 5) | | N/A | | N/A | |
|  | | | dB | | Reference Value in Table 9.5.4.2-2 for each test | | 12 | | 10 | |
|  | | | dB[mW/15kHz] | | Reference Value in Table 9.5.4.2-2 for each test | | -86 | | -88 | |
| Subframe Configuration | | |  | | Non-MBSFN | | Non-MBSFN | | Non-MBSFN | |
| Time Offset between Cells | | | μs | | N/A | | 3 | | -1 | |
| Frequency shift between Cells | | | Hz | | N/A | | 300 | | -100 | |
| Cell Id | | |  | | 0 | | 126 | | 1 | |
| ABS pattern (Note 6) | | |  | | N/A | | 0000000001  0000000001 | | 0000000001  0000000001 | |
| RLM/RRM Measurement Subframe Pattern (Note 7) | | |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CSI Subframe Sets (Note 8) | | CCSI,0 |  | | 0000000001 0000000001 | | N/A | | N/A | |
| CCSI,1 |  | | 1100111000 1100111000 | | N/A | | N/A | |
| Number of control OFDM symbols | | |  | | 3 | | Note 9 | | Note 9 | |
| Maximum number of HARQ transmissions | | |  | | 1 | | N/A | | N/A | |
| Reporting mode | | |  | | PUCCH 1-0 | | N/A | | N/A | |
| Physical channel for CCSI,0 CQI and RI reporting | | |  | | PUCCH format 2 | | N/A | | N/A | |
| Physical channel for CCSI,1 CQI and RI reporting | | |  | | PUSCH (Note 14) | | N/A | | N/A | |
| PUCCH Report Type for CQI | | |  | | 4 | | N/A | | N/A | |
| PUCCH Report Type for RI | | |  | | 3 | | N/A | | N/A | |
| Reporting periodicity | | | ms | | *Npd*= 10 | | N/A | | N/A | |
| ACK/NACK feedback mode | | |  | | Multiplexing | | N/A | | N/A | |
| *cqi-pmi-ConfigurationIndex* | | |  | | 8 | | N/A | | N/A | |
| *ri-ConfigurationInd* | | |  | | 5 | | N/A | | N/A | |
| *cqi-pmi-ConfigurationIndex2* | | |  | | 9 | | N/A | | N/A | |
| *ri-ConfigurationInd2* | | |  | | 0 | | N/A | | N/A | |
| Cyclic prefix | | |  | | Normal | | Normal | | Normal | |
| Note 1: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.  Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  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: The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by “0” of ABS pattern.  Note 10: 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 11: Reference measurement channel in Cell 1 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 12: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.  Note 13: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.  Note 14: 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#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3. | | | | | | | | | | |

Table 9.5.4.2-2: Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| for Cell 1 (dB) | 4 | 20 | 20 |
| for Cell 1 (dB[mW/15kHz]) | -94 | -78 | -78 |
| Antenna correlation | High for Cell 1, low for Cell 2 and Cell 3 | Low for Cell 1, Cell 2 and Cell 3 | High for Cell 1, low for Cell 2 and Cell 3 |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1.05 | N/A | N/A |
| UE Category | ≥2 | ≥2 | ≥2 |

### 9.5.5 Minimum requirement (with CSI process)

Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.5.5-1.

For UE supports one CSI process, CSI process 0 is configured for Test 1 and Test 2, but CSI process 1 is not configured for Test 2. The corresponding  requirements for Test 1 and Test 2 shall be fulfilled. The requirement on reported RI for CSI process 1 in Test 2 is not applicable.

For UE supports multiple CSI processes, CSI process 0 is configured for Test 1 and CSI processes 0 and 1 are configured for Test 2. The corresponding  requirements for Test 1 and Test 2 shall be fulfilled, and also the requirement on reported RI for CSI process 1 in Test 2.

Table 9.5.5-1: Configuration of CSI processes

|  |  |  |
| --- | --- | --- |
|  | CSI process 0 | CSI process 1 |
| CSI-RS resource | CSI-RS signal 0 | CSI-RS signal 1 |
| CSI-IM resource | CSI-IM resource 0 | CSI-IM resource 1 |

#### 9.5.5.1 FDD

The minimum performance requirement in Table 9.5.5.1-2 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 ≥ ;

c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.1-2.

Table 9.5.5.1-1: RI Test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| TP1 | TP2 | TP1 | TP2 |
| Bandwidth | | MHz | 10 MHz | | 10 MHz | |
| Transmission mode | |  | 10 | 10 | 10 | 10 |
| Downlink power allocation |  | dB | 0 | | 0 | |
|  | dB | 0 | | 0 | |
|  | dB | 0 | 0 | 0 | 0 |
| σ | dB | 0 | | 0 | |
| SNR | | dB | 0 | 0 | 20 | 20 |
|  | | dB[mW/15kHz] | -98 | -98 | -78 | -78 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA 5 Low | EPA 5 Low | EPA 5 Low | EPA 5 High |
| Antenna configuration | |  | 2x2 | 2x2 | 2x2 | 2x2 |
| Beamforming Model | |  | As specified in Section B.4.3 | | As specified in Section B.4.3 | |
| Timing offset between TPs | | us | 0 | | 0 | |
| Frequency offset between TPs | | Hz | 0 | | 0 | |
| Cell-specific reference signals | |  | Antenna ports 0 | | Antenna ports 0 | |
| CSI-RS signal 0 | |  | Antenna ports 15,16 | N/A | Antenna ports 15,16 | N/A |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | N/A | 5/1 | N/A |
| CSI-RS 0 configuration | |  | 0 | N/A | 0 | N/A |
| CSI-RS signal 1 | |  | N/A | Antenna ports 15,16 | N/A | Antenna ports 15,16 |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | 5/1 | N/A | 5/1 |
| CSI-RS 1 configuration | |  | N/A | 3 | N/A | 3 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | N/A | 1 / 1000001000000000 | N/A | 1] / 1000001000000000 |
| Zero-power CSI-RS 1 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 1 / 0011000000000000 | N/A | 1 / 0011000000000000 | N/A |
| CSI-IM 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/1 | N/A | 5/1 | N/A |
| CSI-IM 0 configuration | |  | 2 | N/A | 2 | N/A |
| CSI-IM 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | 5/1 | N/A | 5/1 |
| CSI-IM 1 configuration | |  | N/A | 6 | N/A | 6 |
| RI configuration | |  | Fixed RI=2 and follow RI | N/A | Fixed RI=1 and follow RI | N/A |
| Physical channel for CQI/PMI reporting | |  | PUSCH (Note 6) | N/A | PUSCH (Note 6) | PUSCH (Note 6) |
| PUCCH Report Type for CQI/PMI | |  | 2 | N/A | 2 | 2 |
| Physical channel for RI reporting | |  | PUCCH Format 2 | N/A | PUCCH Format 2 | PUCCH Format 2 |
| PUCCH Report Type for RI | |  | 3 | N/A | 3 | 3 |
| CSI process 0 (Note 7) | CSI-RS |  | CSI-RS 0 | N/A | CSI-RS 0 | N/A |
| CSI-IM |  | CSI-IM 0 | N/A | CSI-IM 0 | N/A |
| Reporting mode |  | PUCCH 1-1 | N/A | PUCCH 1-1 | N/A |
| Reporting periodicity | ms | *N*pd = 5 | N/A | *N*pd = 5 | N/A |
| CQI delay | ms | 8 | N/A | 10 | N/A |
| *cqi-pmi-ConfigurationIndex* |  | 6 | N/A | 6 | N/A |
| *ri-ConfigIndex* |  | 1 | N/A | 1 | N/A |
| CSI process 1 (Note 7, Note 9) | CSI-RS |  | N/A | N/A | N/A | CSI-RS 1 |
| CSI-IM |  | N/A | N/A | N/A | CSI-IM 1 |
| Reporting mode |  | N/A | N/A | N/A | PUCCH 1-1 |
| Reporting periodicity | ms | N/A | N/A | N/A | *N*pd = 5 |
| CQI delay | ms | N/A | N/A | N/A | 10 |
| *cqi-pmi-ConfigurationIndex* |  | N/A | N/A | N/A | 4 |
| *ri-ConfigIndex* |  | N/A | N/A | N/A | 1 |
| CSI process for PDSCH scheduling | |  | CSI process 0 | | CSI process 0 | |
| Cell ID | |  | 0 | 6 | 0 | 6 |
| Quasi-co-located CSI-RS | |  | CSI-RS 0 | CSI-RS 1 | CSI-RS 0 | CSI-RS 1 |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | Same Cell ID as Cell 2 | Same Cell ID as Cell 1 | Same Cell ID as Cell 2 |
| PMI for subframe 2, 3, 4, 7, 8 and 9 | |  | 010000 for fixed RI = 2  010011 for UE reported RI | 100000 | 000011 for fixed RI = 1  010011 for UE reported RI | N/A |
| PMI for subframe 1 and 6 | |  | 100000 | 100000 | 100000 | N/A |
| Max number of HARQ transmissions | |  | 1 | N/A | 1 | N/A |
| 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: 3 symbols allocated to PDCCH  Note 3: Reference measurement channel RC.13 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.  Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.  Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.  Note 6: 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 7: If UE supports multiple CSI processes, CSI process 0 is configured as ‘RI-reference CSI process’ for CSI process 1.  Note 8: 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.  Note 9: If UE supports one CSI process, CSI process 1 is not configured in Test 2. | | | | | | |

Table 9.5.5.1-2: Minimum requirement (FDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| **1 | N/A | 1.0 |
| **2 | 1.0 | N/A |
| UE Category | ≥2 | ≥2 |

#### 9.5.5.2 TDD

The minimum performance requirement in Table 9.5.5.2-2 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 ≥ ;

c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.2-2.

Table 9.5.5.2-1: RI Test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | | Test 2 | |
| TP1 | TP2 | TP1 | TP2 |
| Bandwidth | | MHz | 10 MHz | | 10 MHz | |
| Transmission mode | |  | 10 | 10 | 10 | 10 |
| Downlink power allocation |  | dB | 0 | | 0 | |
|  | dB | 0 | | 0 | |
|  | dB | 0 | 0 | 0 | 0 |
| σ | dB | 0 | | 0 | |
| Uplink downlink configuration | |  | 2 | 2 | 2 | 2 |
| Special subframe configuration | |  | 4 | 4 | 4 | 4 |
| SNR | | dB | 0 | 0 | 20 | 20 |
|  | | dB[mW/15kHz] | -98 | -98 | -78 | -78 |
|  | | dB[mW/15kHz] | -98 | | -98 | |
| Propagation channel | |  | EPA 5 Low | EPA 5 Low | EPA 5 Low | EPA 5 High |
| Antenna configuration | |  | 2x2 | 2x2 | 2x2 | 2x2 |
| Beamforming Model | |  | As specified in Section B.4.3 | | As specified in Section B.4.3 | |
| Timing offset between TPs | | us | 0 | | 0 | |
| Frequency offset between TPs | | Hz | 0 | | 0 | |
| Cell-specific reference signals | |  | Antenna ports 0 | | Antenna ports 0 | |
| CSI-RS signal 0 | |  | Antenna ports 15,16 | N/A | Antenna ports 15,16 | N/A |
| CSI-RS 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | N/A | 5/3 | N/A |
| CSI-RS 0 configuration | |  | 0 | N/A | 0 | N/A |
| CSI-RS signal 1 | |  | N/A | Antenna ports 15,16 | N/A | Antenna ports 15,16 |
| CSI-RS 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | 5/3 | N/A | 5/3 |
| CSI-RS 1 configuration | |  | N/A | 3 | N/A | 3 |
| Zero-power CSI-RS 0 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | N/A | 3 / 1000001000000000 | N/A | 3 / 1000001000000000 |
| Zero-power CSI-RS 1 configuration  *I*CSI-RS / *ZeroPowerCSI-RS* bitmap | |  | 3 / 0011000000000000 | N/A | 3 / 0011000000000000 | N/A |
| CSI-IM 0 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | 5/3 | N/A | 5/3 | N/A |
| CSI-IM 0 configuration | |  | 2 | N/A | 2 | N/A |
| CSI-IM 1 periodicity and subframe offset *T*CSI-RS / *∆*CSI-RS | |  | N/A | 5/3 | N/A | 5/3 |
| CSI-IM 1 configuration | |  | N/A | 6 | N/A | 6 |
| RI configuration | |  | Fixed RI=2 and follow RI | N/A | Fixed RI=1 and follow RI | N/A |
| CSI process 0 (Note 6, 7) | CSI-RS |  | CSI-RS 0 | N/A | CSI-RS 0 | N/A |
| CSI-IM |  | CSI-IM 0 | N/A | CSI-IM 0 | N/A |
| Reporting mode |  | PUSCH 3-1 | N/A | PUSCH 3-1 | N/A |
| Reporting Interval | ms | *5* | N/A | *5* | N/A |
| CQI delay | ms | 11 | N/A | 11 | N/A |
| CSI process 1 (Note 6, 7, 8) | CSI-RS |  | N/A | N/A | N/A | CSI-RS 1 |
| CSI-IM |  | N/A | N/A | N/A | CSI-IM 1 |
| Reporting mode |  | N/A | N/A | N/A | PUSCH 3-1 |
| Reporting Interval | ms | N/A | N/A | N/A | *5* |
| CQI delay | ms | N/A | N/A | N/A | 11 |
| CSI process for PDSCH scheduling | |  | CSI process 0 | | CSI process 0 | |
| Cell ID | |  | 0 | 6 | 0 | 6 |
| Quasi-co-located CSI-RS | |  | CSI-RS 0 | CSI-RS 1 | CSI-RS 0 | CSI-RS 1 |
| Quasi-co-located CRS | |  | Same Cell ID as Cell 1 | Same Cell ID as Cell 2 | Same Cell ID as Cell 1 | Same Cell ID as Cell 2 |
| PMI for subframe 4 and 9 | |  | 010000 for fixed RI = 2  010011 for UE reported RI | 100000 | 000011 for fixed RI = 1  010011 for UE reported RI | N/A |
| PMI for subframe 3 and 8 | |  | 100000 | 100000 | 100000 | N/A |
| Max number of HARQ transmissions | |  | 1 | N/A | 1 | N/A |
| ACK/NACK feedback mode | |  | Multiplexing | N/A | Multiplexing | N/A |
| 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: 3 symbols allocated to PDCCH  Note 3: Reference measurement channel RC.13 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.  Note 4: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3 and 8 from TP1.  Note 5: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3, 4, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.  Note 6: Reported wideband CQI and PMI are used and sub-band CQI is discarded.  Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as ‘RI-reference CSI process’ for CSI process 1.  Note 8: If UE supports one CSI process, CSI process 1 is not configured in Test 2.  Note 9: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2. | | | | | | |

Table 9.5.5.2-2: Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| **1 | N/A | 1.0 |
| **2 | 1.0 | N/A |
| UE Category | ≥2 | ≥2 |

## 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. For CA with 2 DL CC, 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, 2 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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, 2 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 10MHz for both cells |
| 2 | 20MHz for both cells |
| 3 | 5MHz for both cells |
| 4 | 5MHz for PCell and 10MHz for SCell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.  Note 2: Mapping of PCell and Scell to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping. | |

The following requirements apply to UE Category ≥5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.1-3 and Table 9.6.1.1-4, 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 SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

wideband CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2 ≥ 2

for more than 90% of the time.

Table 9.6.1.1-3: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 3 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Pcell | Scell1 | Scell2 |
| PDSCH transmission mode | |  | 1 | | |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | |
| SNR | | dB | 12 | 6 | 0 |
|  | | dB[mW/15kHz] | -86 | -92 | -98 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 20 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 21 | 26 (shift of 5 ms relative to Pcell) | 31 (shift of 10 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.  Note 2: Void | | | | | |

Table 9.6.1.1-4: PUCCH 1-0 static test (FDD, 3 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination (MHz) |
| 1 | 3x20 |
| 2 | 20+20+15 |
| 3 | 20+20+10 |
| 4 | 20+15+15 |
| 5 | 20+15+10 |
| 6 | 20+10+10 |
| 7 | 15+15+10 |
| 8 | 20+10+5 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.  Note 2: If more than one cell can be configured as PCell, choose one with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping. | |

#### 9.6.1.2 TDD

The following requirements apply to UE Category ≥3. For CA with 2 DL CC, 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, 2 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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.  Note 2: Void | | | | | |

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

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 20MHz for both cells |
| 2 | 15MHz for PCell and 20MHz for SCell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3. | |

The following requirements apply to UE Category ≥5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.2-3 and Table 9.6.1.2-4, 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 SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

wideband CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2 ≥ 2

for more than 90% of the time.

Table 9.6.1.2-3: PUCCH 1-0 static test on multiple cells (TDD, 3 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Pcell | Scell1 | Scell2 |
| 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 | 12 | 6 | 0 |
|  | | dB[mW/15kHz] | -86 | -92 | -98 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 20 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 18 | 23 (shift of 5 ms relative to Pcell) | 28 (shift of 10 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.  Note 2: Void | | | | | |

Table 9.6.1.2-4: PUCCH 1-0 static test (TDD, 3 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination (MHz) |
| 1 | 3x20 |
| 2 | 20+20+15 |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.  Note 2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. | |

#### 9.6.1.3 TDD-FDD CA with FDD PCell

The following requirements apply to UE Category ≥5. For TDD-FDD CA with FDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.3-1 and Table 9.6.1.3-2, 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 9.6.1.3-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 2 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | PCell | | SCell |
| PDSCH transmission mode | |  | 1 | | |
| Uplink downlink configuration | |  | N/A | 2 | |
| Special subframe configuration | |  | N/A | 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* | |  | 9 | 14 (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 and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.  Note 2: Void  Note 3: Void | | | | | |

Table 9.6.1.3-2: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 2 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 20MHz for FDD cell and 20MHz for TDD cell |
| 2 | 10MHz for FDD cell and 20MHz for TDD cell |
| 3 | 15MHz for FDD cell and 20MHz for TDD cell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3. | |

The following requirements apply to UE Category ≥5. For TDD-FDD CA with FDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-4, 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 SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

wideband CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2 ≥ 2

for more than 90% of the time.

Table 9.6.1.3-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 3 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | PCell | SCell1 | SCell2 |
| PDSCH transmission mode | |  | 1 | | |
| Uplink downlink configuration | |  | N/A | 2 if Scell1 is TDD Cell  N/A if Scell1 is FDD Cell | 2 |
| Special subframe configuration | |  | N/A | 4 if Scell1 is TDD Cell  N/A if Scell1 is FDD Cell | 4 |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | |
| SNR | | dB | 12 | 6 | 0 |
|  | | dB[mW/15kHz] | -86 | -92 | -98 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 20 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 19 | 24 (shift of 5 ms relative to Pcell) | 29 (shift of 10 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 and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.  Note 2: Void  Note 3: Void | | | | | |

Table 9.6.1.4-4: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 3 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination (MHz) |
| 1 | 20MHz for FDD cell and 2x20MHz for TDD cell |
| 2 | 15MHz for FDD cell and 2x20MHz for TDD cell |
| 3 | 10MHz for FDD cell and 2x20MHz for TDD cell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3. | |

#### 9.6.1.4 TDD-FDD CA with TDD PCell

The following requirements apply to UE Category ≥5. For TDD-FDD CA with TDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.4-1 and Table 9.6.1.4-2, 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 9.6.1.4-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 2 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | PCell | | SCell |
| PDSCH transmission mode | |  | 1 | | |
| Uplink downlink configuration | |  | 2 | N/A | |
| Special subframe configuration | |  | 4 | N/A | |
| 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 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.  Note 2: Void  Note 3: Void | | | | | |

Table 9.6.1.4-2: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 2 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination |
| 1 | 20MHz for TDD cell and 20MHz for FDD cell |
| 2 | 20MHz for TDD cell and 10MHz for FDD cell |
| 3 | 20MHz for TDD cell and 15MHz for FDD cell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3. | |

The following requirements apply to UE Category ≥5. For TDD-FDD CA with TDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-4, 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 SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

wideband CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2 ≥ 2

for more than 90% of the time.

Table 9.6.1.4-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 3 DL CA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | PCell | SCell1 | SCell2 |
| PDSCH transmission mode | |  | 1 | | |
| Uplink downlink configuration | |  | 2 | 2 if Scell1 is TDD Cell  N/A if Scell1 is FDD Cell | N/A |
| Special subframe configuration | |  | 4 | 4 if Scell1 is TDD Cell  N/A if Scell1 is FDD Cell | N/A |
| Downlink power allocation |  | dB | 0 | | |
|  | dB | 0 | | |
| Propagation condition and antenna configuration | |  | AWGN (1 x 2) | | |
| SNR | | dB | 12 | 6 | 0 |
|  | | dB[mW/15kHz] | -86 | -92 | -98 |
|  | | dB[mW/15kHz] | -98 | -98 | -98 |
| Physical channel for CQI reporting | |  | PUCCH Format 2 | | |
| PUCCH Report Type | |  | 4 | | |
| Reporting periodicity | | ms | *N*pd = 20 | | |
| *cqi-pmi-ConfigurationIndex* | |  | 18 | 23 (shift of 5 ms relative to Pcell) | 28 (shift of 10 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 and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.  Note 2: Void  Note 3: Void | | | | | |

Table 9.6.1.3-4: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 3 DL CA)

|  |  |
| --- | --- |
| Test number | Bandwidth combination (MHz) |
| 1 | 2x20MHz for TDD cell and 20MHz for FDD cell |
| 2 | 2x20MHz for TDD cell and 15MHz for FDD cell |
| 3 | 2x20MHz for TDD cell and 10MHz for FDD cell |
| Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3. | |

## 9.7 CSI reporting (Single receiver antenna)

The number of receiver antennas NRX assumed for the minimum performance requirement in this clause is 1.

### 9.7.1 CQI reporting definition under AWGN conditions

#### 9.7.1.1 FDD and half-duplex FDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.1-1, 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.16 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 9.7.1.1-1: PUCCH 1-0 static test (FDD and half-duplex 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 1) | | | |
| 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 | *Npd* = 40 | | | |
| *cqi-pmi-ConfigurationIndex* | |  | 41 | | | |
| Note 1: Reference measurement channel RC.16 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/OP.2 FDD as described in Annex A.5.1.1/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. | | | | | | |

#### 9.7.1.2 TDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.2-1, 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.16 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 9.7.1.2-1: 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 1) | | | |
| 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.16 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/OP.2 TDD as described in Annex A.5.2.1/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. | | | | | | |

### 9.7.2 CQI reporting under fading conditions

#### 9.7.2.1 FDD and half-duplex FDD

For the parameters specified in Table 9.7.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.1-2 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 and in each available downlink transmission instance for half-duplex FDD.

Table 9.7.2.1-1 Sub-band test for single antenna transmission (FDD and half-duplex 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 | | | |
| Antenna configuration | | |  | 1 x 1 | | | |
| Reporting interval | | | ms | 8 | | | |
| 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.16 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 9.7.2.1-2 Minimum requirement (FDD and half-duplex FDD)**

|  |  |  |
| --- | --- | --- |
|  | **Test 1** | **Test 2** |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| UE DL Category | 0 | 0 |

#### 9.7.2.2 TDD

For the parameters specified in Table 9.7.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.2-2 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 available downlink transmission instance for TDD.

Table 9.7.2.2-1 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 | | | | |
| Antenna configuration | | | |  | | 1 x 1 | | | | |
| 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.16 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 9.7.2.2-2 Minimum requirement (TDD)

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** [%] | 55 | 55 |
| ** | 1.1 | 1.1 |
| UE DL Category | 0 | 0 |

# 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 |
| 2 | 10 MHz | R.38 FDD | OP.4 FDD | 11.0 | ≥1 |
| 3 | 10 MHz | R.39 FDD | OP.4 FDD | 20.1 | ≥2 |
|  | 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 |
| 2 | 10 MHz | R.38 TDD | OP.4 TDD | 11.1 | ≥1 |
| 3a | 10 MHz | R.39 TDD | OP.4 TDD | 20.1 | ≥2 |
| 3b | 5MHz | R.39-1 TDD | OP.4 TDD | 20.5 | 1 |

# 11 Performance requirement (ProSe Direct Discovery)

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Discovery.

## 11.1 General

### 11.1.1 Applicability of requirements

The requirements in this clause are applicable to UEs that support ProSe Direct Discovery. Some of the tests defined in this clause are applicable only to UEs that additionally support transmission and reception of Sidelink synchronization signal (indicated using *disc-SLSS*). The test case applicability is in according to table 11.1.1-1 depending on UE capability.

Table 11.1.1-1: ProSe Direct Discovery test applicability

|  |  |  |
| --- | --- | --- |
|  | ProSe Direct Discovery without support of SLSS | ProSe Direct Discovery with support of SLSS |
| FDD | 11.2.1, 11.3.1, 11.5.1 | 11.3.1, 11.4.1, 11.5.1 |
| TDD | 11.2.2, 11.3.2, 11.5.2 | 11.2.2, 11.3.2, 11.5.2 |

For maximum Sidelink Processes test specified in clause 11.5, the UE is required to only meet the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE.

### 11.1.2 Reference DRX configuration

Table 11.1.2-1: Reference DRX configuration

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comments |
| onDurationTimer | psf1 |  |
| drx-InactivityTimer | psf1 |  |
| drx-RetransmissionTimer | psf1 |  |
| longDRX-CycleStartOffset | sf2560, 0 |  |
| shortDRX | disabled |  |
| NOTE: For further information see clause 6.3.2 in TS 36.331. | | |

## 11.2 Demodulation of PSDCH (single link performance)

The purpose of the requirements in this subclause is to verify the PSDCH demodulation performance with a single active PSDCH link under different operating scenarios and channel conditions.

The active cell(s), when present, are specified in the test parameters specific to the test.

### 11.2.1 FDD

The minimum requirements are specified in Table 11.2.1-2 with the test parameters specified in Table 11.2.1-1. The receiver UE under test is associated with Cell 1.

Table 11.2.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.1-1  (Configuration #1-FDD) |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| at antenna port (NOTE 3) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern (NOTE 2) | |  | OP.1 FDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1 |
| Sidelink UE 1 | Sidelink Transmissions | |  | PSDCH |
| PSDCH RB allocation | |  | PRB pairs {2i, 2i+1), where i is chosen randomly uniformly from [0,11] in each discovery period. |
| Time offset (NOTE 4) | | μs | +1 |
| Frequency offset (NOTE 5) | | Hz | +200 |
| Propagation Channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.2.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Sidelink UE | Band-width | Reference channel | Reference value | |
| BLER of PSDCH (%) | SNR (dB) |
| 1 | 1 | 5 MHz | D.1 FDD | 30 | 4.6 |

### 11.2.2 TDD

The minimum requirements are specified in Table 11.2.2-2 with the test parameters specified in Table 11.2.2-1. The receiver UE under test is associated with Cell 1.

Table 11.2.2-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.2-1  (Configuration #1-TDD) |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| at antenna port (NOTE 5) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Uplink downlink configuration (NOTE 3) | |  | 0 |
| Special subframe configuration (NOTE 4) | |  | 4 |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 TDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1 |
| Sidelink UE 1 | Sidelink Transmissions | |  | PSDCH |
| RB allocation | |  | PRB pairs {2i, 2i+1), where i is chosen randomly uniformly from [0,11] in each discovery period. |
| Time offset (NOTE 6) | | μs | +1 |
| Frequency offset (NOTE 7) | | Hz | +200 |
| Propagation Channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].  NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].  NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery.  NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.2.2-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Sidelink UE | Band-width | Reference channel | Reference value | |
| BLER of PSDCH (%) | SNR (dB) |
| 1 | 1 | 5 MHz | D.1 TDD | 30 | 4.6 |

## 11.3 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSDCH transmissions from two Sidelink UEs with power imbalance in one subframe.

### 11.3.1 FDD

The minimum requirements are specified in Table 11.3.1-2 with the test parameters specified in Table 11.3.1-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.1-1  (Configuration #1-FDD) |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| at antenna port (NOTE 3) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern (NOTE 2) | |  | OP.1 FDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions | |  | PSDCH |
| PSDCH RB allocation | |  | PRB pairs {4, 5) |
| Time offset (NOTE 3) | | μs | 0 |
| Frequency offset (NOTE 4) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 Low |
| Sidelink UE 2 | Sidelink Transmissions | |  | PSDCH |
| PSDCH RB allocation | |  | PRB pairs {6, 7) |
| Time offset (w.r.t. Cell 1 DL) | | μs | 0 |
| Frequency offset (w.r.t. Cell 1 UL) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 Low |
| Applicability to UEs supporting | | |  | Discovery |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.3.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Sidelink UE | Reference channel | Reference value | |
| BLER of PSDCH (%) | SNR (dB) |
| 1 | 5 MHz | 1 | D.1 FDD | (NOTE 1) | 24.3 |
| 2 | D.1 FDD | 30 | 6.9 |
| NOTE 1: There is no BLER requirement for Sidelink UE 1. | | | | | |

### 11.3.2 TDD

The minimum requirements are specified in Table 11.3.2-2 with the test parameters specified in Table 11.3.2-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.2-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.2-1  (Configuration #1-TDD) |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| at antenna port (NOTE 5) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Uplink downlink configuration (NOTE 3) | |  | 0 |
| Special subframe configuration (NOTE 4) | |  | 4 |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 TDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions | |  | PSDCH |
| PSDCH RB allocation | |  | PRB pairs {4, 5) |
| Time offset (NOTE 6) | | μs | 0 |
| Frequency offset (NOTE 7) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 Low |
| Sidelink UE 2 | Sidelink Transmissions | |  | PSDCH |
| RB allocation | |  | PRB pairs {6, 7) |
| Time offset (NOTE 6) | | μs | 0 |
| Frequency offset (NOTE 7) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].  NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].  NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery.  NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.3.2-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Sidelink UE | Reference channel | Reference value | |
| BLER of PSDCH (%) | SNR (dB) |
| 1 | 5 MHz | 1 | D.1 TDD | (NOTE 1) | 24.3 |
| 2 | D.1 TDD | 30 | 6.9 |
| NOTE 1: There is no BLER requirement for Sidelink UE 1. | | | | | |

## 11.4 Multiple timing reference test

The purpose of this test is to check the demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overlapping in time).

### 11.4.1 FDD

The test parameters are specified in Table 11.4.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and 3 are associated with another cell and use a different timing, and UE 1 acts as a synchronization reference. The minimum requirements are specified in Table 11.4.1-2.

Table 11.4.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.1-2  (Configuration #2-FDD) |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| at antenna port (NOTE 3) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 FDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UEs 1, 2, 3 |
| Sidelink UE 1 | Sidelink Transmissions | |  | SLSS |
| networkControlledSyncTx | |  | ON |
| slssid | |  | 30 |
| Time offset (NOTE 4) | | μs | 3511 |
| Frequency offset (NOTE 5) | | Hz | -100 |
| Propagation channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| of SLSS at antenna port | | dBm/15kHz | -82 |
| Sidelink UE 2 | Sidelink Transmissions | |  | PSDCH |
| Resource pool used for transmissions | |  | *discRxPool(0)* |
| RB allocation | |  | PRB pairs {2i, 2i+1), where i is chosen randomly uniformly from [0,11] in each discovery period. |
| Time offset (NOTE 4) | | μs | +1 |
| Frequency offset (NOTE 5) | | Hz | +200 |
| Propagation Channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| Sidelink UE 3 | Sidelink Transmissions | |  | PSDCH |
| Resource pool used for transmissions | |  | *discRxPool(1)* |
| RB allocation | |  | PRB pairs {2i, 2i+1), where i is chosen randomly uniformly from [0,11] in each discovery period. |
| Time offset (NOTE 4) | | μs | 3511 |
| Frequency offset (NOTE 5) | | Hz | +300 |
| Propagation Channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.4.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Sidelink UE | Reference channel | Reference value | |
| **BLER of PSDCH (%)NOTE 1** | SNR (dB) |
| 1 | 5 MHz | 2 | D.1 FDD | 30 | 4.6 |
| 3 | D.1 FDD | 30 | 4.6 |
| NOTE 1: The BLER is measured after 5 D2D Discovery periods (1600 frames) of lead time during which the test UE detects and synchronizes to Sidelink UE 1 SLSS. | | | | | |

## 11.5 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes supported by the UE as reported using UE capability signalling (*discSupportedProc*).

The UE is required to meet only the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE.

### 11.5.1 FDD

The test parameters are specified in Table 11.5.1-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.1-2.

Table 11.5.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1-7 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.1-3  (Configuration #3-FDD)  with parameters BWChannel, NPools = Number of configured resource pools (as specified in Table 11.5.1-2), and N = discSupportedProc |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 FDD |
| Propagation channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -85 |
| Active Sidelink UE(s) | | |  | Sidelink UE i, i = 0, …, discSupportedProc-1 |
| Sidelink UE i | Sidelink Transmissions | |  | PSDCH (D.1 FDD) |
| Resource pool index (NOTE 3) | |  |  |
| PSDCH RB allocation (NOTE 3) | |  | PRB pairs {2\*(i % NMAX\_SF), 2\*(i % NMAX\_SF)+1} |
| Time offset (NOTE 4) | | μs | 0 |
| Frequency offset (NOTE 5) | | Hz | 0 |
| Propagation Channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs..  NOTE 3: NMAX\_SF represents the maximum number of Sidelink UEs transmitting in one subframe. NMAX\_SF = 12 (5 MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.5.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth | discSupportedProc | Number of configured resource pools | at antenna port (dBm/15kHz) | Reference value  for Sidelink UE i=0…discSupportedProc-1 |
| Fraction of maximum throughput (%) |
| 1 | 5 MHz | 50 | 5 | -85 | 95 |
| 2 | 10 MHz | 50 | 2 | -85 | 95 |
| 3 | 15 MHz | 50 | 2 | -85 | 95 |
| 4 | 20 MHz | 50 | 1 | -85 | 95 |
| 5 | 10 MHz | 400 | 16 | -85 | 95 |
| 6 | 15 MHz | 400 | 11 | -85 | 95 |
| 7 | 20 MHz | 400 | 8 | -85 | 95 |

### 11.5.2 TDD

The test parameters are specified in Table 11.5.2-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.2-2.

Table 11.5.2-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1-7 |
| Discovery resource pool configuration | | |  | As specified in Table A.7.1.2-2  (Configuration #2-TDD)  with parameters BWChannel, NPools = Number of configured resource pools (as specified in Table 11.5.2-2), and N = discSupportedProc |
| DRX configuration | | |  | As specified in Table 11.1.2-1 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Uplink downlink configuration (NOTE 3) | |  | 0 |
| Special subframe configuration (NOTE 4) | |  | 4 |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 TDD |
| Propagation channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -85 |
| Active Sidelink UE(s) | | |  | Sidelink UE i, i = 0, …, discSupportedProc-1 |
| Sidelink UE i | Sidelink Transmissions | |  | PSDCH (D.1 TDD) |
| PSDCH Resource pool(NOTE 5) | |  |  |
| PSDCH RB allocation (NOTE 5) | |  | PRB pairs {2\*(i % NMAX\_SF), 2\*(i % NMAX\_SF)+1} |
| Time offset (NOTE 6) | | μs | 0 |
| Frequency offset (NOTE 7) | | Hz | 0 |
| Propagation Channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].  NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].  NOTE 5: NMAX\_SF represents the maximum number of Sidelink UEs transmitting in one subframe. NMAX\_SF = 12 (5 MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).  NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 11.5.2-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth | discSupportedProc | Number of configured resource pools | at antenna port (dBm/15kHz | Reference value |
| Fraction of maximum throughput (%) for Sidelink UE i=0…discSupportedProc-1 |
| 1 | 5 MHz | 50 | 5 | -85 | 95 |
| 2 | 10 MHz | 50 | 2 | -85 | 95 |
| 3 | 15 MHz | 50 | 2 | -85 | 95 |
| 4 | 20 MHz | 50 | 1 | -85 | 95 |
| 5 | 10 MHz | 400 | 16 | -85 | 95 |
| 6 | 15 MHz | 400 | 11 | -85 | 95 |
| 7 | 20 MHz | 400 | 8 | -85 | 95 |

# 12 Performance requirement (ProSe Direct Communication)

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Communication in TS 36.211 [4].

## 12.1 General

### 12.1.1 Applicability of requirements

The requirements in this clause are applicable to UEs that support ProSe Direct Communication. Test cases defined for 5MHz channel bandwidth are applicable to UEs that support ProSe Direct Communication on only Band 31.

### 12.1.2 Reference DRX configuration

Table 12.1.2-1: Reference DRX configuration

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Comments |
| onDurationTimer | psf1 |  |
| drx-InactivityTimer | psf1 |  |
| drx-RetransmissionTimer | psf1 |  |
| longDRX-CycleStartOffset | sf2560, 0 |  |
| shortDRX | disabled |  |
| NOTE: For further information see clause 6.3.2 in TS 36.331. | | |

## 12.2 Demodulation of PSSCH

The purpose of the requirements in this subclause is to verify the PSSCH demodulation performance with a single active PSSCH link.

### 12.2.1 FDD

The minimum requirements are specified in Table 12.2.1-2 with the test parameters specified in Table 12.2.1-1. This test specifies an out-of-coverge scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.2.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Communication resource pool configuration | |  | As specified in Table A.7.2.1-1  (Configuration #1-FDD) |
| at antenna port (NOTE 1) | | dBm/15kHz | -98 |
| Active cell(s) | |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | SLSS + PSBCH |
| networkControlledSyncTx |  | ON |
| slssid |  | 30 |
| inCoverage (in MIB-SL) |  | FALSE |
| syncOffsetIndicator |  | Set same as syncOffsetIndicator1 in Configuration #1-FDD |
| Propagation channel |  | EPA5 |
| Antenna configuration |  | 1x2 Low |
| at antenna port | dBm/15kHz | -85 |
| Sidelink UE 2 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSCCH RMC |  | 5MHz: CC.3 FDD  10 MHz: CC.4 FDD |
| PSCCH subframe allocation |  | As defined by TS 36.213 with  chosen randomly (uniformly) in every sc-period |
| PSCCH RB allocation |  |
| of PSCCH at antenna port | dBm/15kHz | -85 |
| PSSCH RMC |  | As specificied in Table 12.2.1-2 |
| PSSCH subframe allocation |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation |  | First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213  HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213 |
| Time offset (NOTE 2) | μs | +1 |
| Frequency offset (NOTE 3) | Hz | +200 |
| Propagation Channel |  | EVA70 |
| Antenna configuration |  | 1x2 Low |
| NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.  NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.  NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency. | | | |

Table 12.2.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Sidelink UE | Band-width | PSSCH Reference channel | Reference value | |
| Fraction of maximum throughput (%) (NOTE 1) | SNR (dB) of PSSCH |
| 1 | 2 | 10 MHz | CD.1 FDD | 70 | -3.4 |
| 5 MHz | 70 | -3.3 |
| NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1. | | | | | |

## 12.3 Demodulation of PSCCH

The purpose of the requirements in this subclause is to verify the PSCCH demodulation performance with a single active PSSCH link.

### 12.3.1 FDD

The minimum requirements are specified in Table 12.3.1-2 with the test parameters specified in Table 12.3.1-1. This test specifies an out-of-coverage scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.3.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Communication resource pool configuration | |  | As specified in Table A.7.2.1-1  (Configuration #1-FDD) |
| at antenna port (NOTE 1) | | dBm/15kHz | -98 |
| Active cell(s) | |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | SLSS + PSBCH |
| networkControlledSyncTx |  | ON |
| slssid |  | 30 |
| inCoverage (in MIB-SL) |  | FALSE |
| syncOffsetIndicator |  | Set same as syncOffsetIndicator1 in Configuration #1-FDD |
| Propagation channel |  | EPA5 |
| Antenna configuration |  | 1x2 Low |
| at antenna port | dBm/15kHz | -85 |
| Sidelink UE 2 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSCCH RMC |  | As specified in Table 12.3.1-2 |
| PSCCH subframe allocation |  | As defined by TS 36.213 with  chosen randomly (uniformly) in every sc-period |
| PSCCH RB allocation |  |
| PSSCH RMC |  | CD.1 FDD |
| PSSCH subframe allocation |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation |  | First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213  HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213 |
| Time offset (NOTE 2) | μs | +1 |
| Frequency offset (NOTE 3) | Hz | +200 |
| Propagation Channel |  | EVA70 |
| Antenna configuration |  | 1x2 Low |
| NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.  NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.  NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency. | | | |

Table 12.3.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Sidelink UE | Band-width | PSCCH Reference channel | Reference value | |
| Probability of missed PSCCH (%) (NOTE 1) | SNR (dB) of PSCCH |
| 1 | 2 | 10 MHz | CC.4 FDD | 1 | 4.7 |
| 5 MHz | CC.3 FDD | 1 | 4.8 |
| NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1. | | | | | |

## 12.4 Demodulation of PSBCH

The purpose of the requirements in this subclause is to verify the PSBCH demodulation performance with a single active link.

### 12.4.1 FDD

The minimum requirements are specified in Table 12.4.1-2 with the test parameters specified in Table 12.4.1-1.

Table 12.4.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Communication resource pool configuration | |  | As specified in Table A.7.2.1-1  (Configuration #1-FDD) |
| at antenna port | | dBm/15kHz | -98 |
| Active cell(s) | |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | SLSS + PSBCH (CP.1 FDD) |
| networkControlledSyncTx |  | ON |
| slssid |  | 30 |
| inCoverage (in MIB-SL) |  | FALSE |
| syncOffsetIndicator |  | Set same as syncOffsetIndicator1 in Configuration #1-FDD |
| Propagation channel |  | EPA5 |
| Antenna configuration |  | 1x2 Low |

Table 12.4.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Sidelink UE | Band-width | Reference channel | Reference value | |
| Probability of missed PSBCH (%) (NOTE 1) | SNR (dB) |
| 1 | 1 | 10 MHz | PSBCH  (CP.1 FDD) | 1 | 4.4 |
| 5 MHz |
| NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1. | | | | | |

## 12.5 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one subframe.

### 12.5.1 FDD

The test parameters in Table 12.5.1-1 specifies an in-coverage scenario where Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSSCH on adjacent RBs. The minimum requirements are specified in Table 12.5.1-2.

Table 12.5.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Communication resource pool configuration | | |  | As specified in Table A.7.2.1-2  (Configuration #2-FDD) |
| DRX configuration | | |  | As specified in Table 12.1.2-1 |
| at antenna port (NOTE 3) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern (NOTE 2) | |  | OP.1 FDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions | |  | PSCCH + PSSCH |
| PSCCH RMC | |  | 5 MHz: CC.1 FDD  10 MHz: CC.2 FDD |
| PSCCH subframe allocation | |  | (as defined in TS 36.213) |
| PSCCH RB allocation | |  |
| of PSCCH at antenna port | | dBm/15kHz | -85 |
| PSSCH RMC | |  | As specified in Table 12.5.1-2 |
| PSSCH subframe allocation | |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation | |  | PRB pairs {4, 5) |
| Time offset (NOTE 4) | | μs | 0 |
| Frequency offset (NOTE 5) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| Sidelink UE 2 | Sidelink Transmissions | |  | PSCCH + PSSCH |
| PSCCH RMC | |  | 5 MHz: CC.1 FDD  10 MHz: CC.2 FDD |
| PSCCH subframe allocation | |  | (as defined in TS 36.213) |
| PSCCH RB allocation | |  |
| of PSCCH at antenna port | | dBm/15kHz | -85 |
| PSSCH RMC | |  | As specified in Table 12.5.1-2 |
| PSSCH subframe allocation | |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation | |  | PRB pairs {6, 7) |
| Time offset (NOTE 4) | | μs | 0 |
| Frequency offset (NOTE 5) | | Hz | 0 |
| Propagation Channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 12.5.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Sidelink UE | PSSCH Reference channel | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) of PSSCH |
| 1 | 5 / 10 MHz | 1 | CD.5 FDD | (NOTE 1) | 24.35 |
| 2 | CD.5 FDD | 70 | 2.4 |
| NOTE 1: There is no throughput requirement for Sidelink UE 1. | | | | | |

## 12.6 Multiple timing reference test

The puporse of this test is to check the PSSCH demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overalapping in time).

### 12.6.1 FDD

The test parameters are specified in Table 12.6.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and Sidelink UE 3 are associated with another cell and use a different timing, and Sidelink UE 1 acts as a synchronization reference only. The minimum requirements are specified in Table 12.6.1-2.

Table 12.6.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Communication resource pool configuration | | |  | As specified in Table A.7.2.1-3  (Configuration #3-FDD) |
| DRX configuration | | |  | As specified in Table 12.1.2-1 |
| at antenna port (NOTE 3) | | | dBm/15kHz | -98 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern NOTE 2 | |  | OP.1 FDD |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -92 |
| Active Sidelink UE(s) | | |  | Sidelink UE 1, Sidelink UE 2, Sidelink UE 3 |
| Sidelink UE 1 | Sidelink Transmissions | |  | SLSS + PSBCH |
| networkControlledSyncTx | |  | ON |
| slssid | |  | 30 |
| inCoverage (in MIB-SL) | |  | TRUE |
| syncOffsetIndicator | |  | Set same as syncOffsetIndicator in Configuration #3-FDD |
| Time offset (NOTE 5) | | ms | +12.51 |
| Frequency offset (NOTE 6) | | Hz | -100 |
| Propagation channel | |  | EPA5 |
| Antenna configuration | |  | 1x2 Low |
| at antenna port | | dBm/15kHz | -85 |
| Sidelink UE 2 | Sidelink Transmissions | |  | PSCCH + PSSCH |
| Resource pool | |  | *commRxPool(0)* |
| PSCCH RMC | |  | 5MHz: CC.1 FDD  10 MHz: CC.2 FDD  (NOTE 5) |
| PSCCH subframe allocation | |  | As defined by TS 36.213 with  chosen randomly (uniformly) in every sc-period |
| PSCCH RB allocation | |  |
| of PSCCH at antenna port | | dBm/15kHz | -85 |
| PSSCH RMC | |  | As specified in Table 12.6.1-2 |
| PSSCH subframe allocation | |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation | |  | First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213  HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213 |
| Time offset (NOTE 4, 5) | |  | PSCCH: +1μs PSSCH: +1μs – 288Ts |
| Frequency offset (NOTE 6) | | Hz | +200 |
| Propagation Channel | |  | EVA70 |
| Antenna configuration | |  | 1x2 Low |
| Sidelink UE 3 | Sidelink Transmissions | |  | PSCCH + PSSCH |
| Resource pool | |  | *commRxPool(1)* |
| PSCCH RMC | |  | 5MHz: CC.5 FDD  10 MHz: CC.6 FDD |
| PSCCH subframe allocation | |  | As defined by TS 36.213 with  chosen randomly (uniformly) in every sc-period |
| PSCCH RB allocation | |  |
| of PSCCH at antenna port | | dBm/15kHz | -85 |
| PSSCH RMC | |  | As specified in Table 12.6.1-2 |
| PSSCH subframe allocation | |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation | |  | First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213  HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213 |
| Time offset (NOTE 5) | | ms | +12.509 |
| Frequency offset (NOTE 6) | | Hz | +300 |
| Propagation Channel | |  | EVA70 |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.  NOTE 4: Timing advance indication in PSSCH is set as 18 (=288Ts) in this test. PSSCH timing is advanced with respect to PSCCH timing by the quantity (i.e., PSSCH timing shall be +1μs – 288Ts in this test).  NOTE 5: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 6: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 12.6.1-2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Band-width | Sidelink UE | PSSCH Reference channel | Reference value | |
| Fraction of maximum throughput (%) (NOTE 1) | SNR (dB) |
| 1 | 10 MHz | 2 | CD.4 FDD | 70 | 3.0 |
| 3 | CD.2 FDD | 70 | 2.8 |
| 5 MHz | 2 | CD.3 FDD | 70 | 2.9 |
| 3 | CD.2 FDD | 70 | 2.8 |
| NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1. | | | | | |

## 12.7 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes and the maximum number of bits per TTI supported by the UE.

### 12.7.1 FDD

The test parameters are specified in Table 12.7.1-1. Multiple communication resource pools are interleaved. Each active Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 12.7.1-2.

Table 12.7.1-1: Test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 |
| Communication resource pool configuration | | |  | As specified in Table A.7.2.1-4  (Configuration #4-FDD) |
| DRX configuration | | |  | As specified in Table 12.1.2-1 |
| Active cell(s) | | |  | Cell 1 (Serving cell) |
| Cell 1 | Cyclic prefix | |  | Normal |
| Cell ID | |  | 0 |
| Downlink power allocation |  | dB | 0 |
|  | dB | 0 (NOTE 1) |
| σ | dB | 0 |
| OCNG Pattern (NOTE 2) | |  | OP.1 FDD |
| Propagation channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 |
| RSRP | | dBm/15kHz | -85 |
| Active Sidelink UE(s) | | |  | Sidelink UE i, 0 ≤ i ≤ 15 |
| Sidelink UE i,  0 ≤ i ≤ 15 | Sidelink Transmissions | |  | PSCCH + PSSCH |
| Resource pool | |  | *commRxPool()* |
| PSCCH RMC | |  | 5MHz: CC.1 FDD with ITRP=i%8 (NOTE 3)  10 MHz: CC.2 FDD with ITRP= i%8 (NOTE 3) |
| PSCCH subframe allocation | |  | As defined by TS 36.213 with  = i |
| PSCCH RB allocation | |  |
| PSSCH RMC | |  | As specified in Table 12.7.1-2 |
| PSSCH subframe allocation | |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation | |  | Fully allocated |
| Time offset (NOTE 4) | | μs | 0 |
| Frequency offset (NOTE 5) | | Hz | 0 |
| Propagation Channel | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 Low |
| NOTE 1: .  NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.  NOTE 3: For NTRP = 8 (FDD) and *trpt-Subset* = 001, ITRP = 0 corresponds to a time repetition pattern of (1,0,0,0,0,0,0,0), ITRP = 1 corresponds to a time repetition pattern of (0,1,0,0,0,0,0,0), etc.  NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | | |

Table 12.7.1-2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test num. | Bandwidth | PSCCH Reference channel | at antenna port (dBm/15kHz) | Reference value  for Sidelink UE i=0…15 |
| Fraction of maximum throughput (%) |
| 1 | 10 MHz | CD.7 FDD | -85 | 95 |
| 5 MHz | CD.6 FDD | -85 | 95 |

## 12.8 Sustained downlink data rate with active Sidelink

The purpose of this test is to verify the downlink data rate is not impacted when Sidelink resource are also configured. The test parameters are in Table 12.8.1-1. Cell 1 is the serving cell and UE 1 and UE 2 are transmitters of Prose Direct Communication. The test UE is expected to receive all PDSCH transmissions, and prioritize the transmission of ACK/NACK over the reception of UE 2’s PSSCH.

The test cases apply to UE categories and bandwidth combinations with maximum aggregated bandwidth as specified in Table 12.8.1-2. The minimum requirements are specified in Table 12.8.1-3. The TB success rate in the cellular link shall be sustained during at least 300 frames.

Table 12.8.1-1: Test parameters for sustained downlink data rate (FDD 64QAM) with active Sidelink

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1, 2, 3A |
| Communication resource pool configuration | |  | As specified in Table A.7.2.1-5  (Configuration #5-FDD) |
| Active cell(s) | |  | Cell 1 (Serving cell) |
| Cell 1 | Test parameters |  | As specified in clause 8.7.1: Table 8.7.1-1 and Test 1, 2, 3A in Table 8.7.1-2 |
| Active Sidelink UE(s) | |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSCCH RMC |  | 10 MHz: CC.2 FDD with ITRP=0 (NOTE 1) |
| PSCCH subframe allocation |  | As defined by TS 36.213 with  = 0 |
| PSCCH RB allocation |  |
| PSSCH RMC |  | 10 MHz: CD.7 FDD |
| PSSCH subframe allocation |  | As per time repetition pattern specified in PSCCH |
| PSSCH RB allocation |  | Fully allocated |
| Time offset (NOTE 3) | μs | 0 |
| Frequency offset (NOTE 4) | Hz | 0 |
| Propagation Channel |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration |  | 1x2 Low |
| at antenna port | dBm/15kHz | -85 |
| Sidelink UE 2 | Sidelink Transmissions |  | PSCCH (NOTE 2) |
| PSCCH RMC |  | 10 MHz: CC.2 FDD with ITRP=1 (NOTE 1) |
| PSCCH subframe allocation |  | As defined by TS 36.213 with  = 1 |
| PSCCH RB allocation |  |
| Time offset (NOTE 3) | μs | 0 |
| Frequency offset (NOTE 4) | Hz | 0 |
| Propagation Channel |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration |  | 1x2 Low |
| at antenna port | dBm/15kHz | -85 |
| NOTE 1: For NTRP = 8 (FDD) and *trpt-Subset* = 001, ITRP = 0 corresponds to a time repetition pattern of (1,0,0,0,0,0,0,0), ITRP = 1 corresponds to a time repetition pattern of (0,1,0,0,0,0,0,0).  NOTE 2: Sidelink UE 2 transmits PSCCH but not PSSCH.  NOTE 3: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.  NOTE 4: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency. | | | |

Table 12.8.1-2: Test cases for sustained data rate

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CA config | Maximum supported Bandwidth/ Bandwidth combination (MHz) | Cat. 1 | Cat. 2 | Cat. 3 | Cat. 4 | Cat. 6,7 | Cat. 9,10 | Cat 11, 12 |
| Single carrier | 10 | 1 | 2 | 3A | 3A | 3A | 3A | 3A |

Table 12.8.1-3: Minimum requirements (FDD 64QAM) with active Sidelink

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test | Bandwidth (MHz) | Number of bits of a DL-SCH transport block received within a TTI | Measurement channel | Reference value |
|  | PDSCH TB success rate (%) |
| 1 | 10 | 10296 | R.31-1 FDD (NOTE 2) | 95 |
| 2 | 10 | 25456 | R.31-2 FDD (NOTE 2) | 95 |
| 3A | 10 | 36696 (NOTE 1) | R.31-3A FDD (NOTE 2) | 85 |
| NOTE 1: 35160 bits for sub-frame 5.  NOTE 2: PDSCH scheduling pattern is changed as per the following bitmap that repeats every 40ms. PDSCH scheduling subframe bitmap = {01110111 11110111 11110111 11110111 11111110}. | | | | |