**3GPP TSG- Meeting # *5050***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | 1 | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | eMTC/NB-IoT UE demodulation requirements using time-varying Doppler shift and propagation delay model for NGSO is not specified.  |
|  |  |
| ***Summary of change:*** | Introduce eMTC/NB-IoT UE demodulation requirements using time-varying Doppler shift and propagation delay model for NGSO. |
|  |  |
| ***Consequences if not approved:*** | Cannot verify eMTC/NB-IoT UE demodulation requirements using time-varying Doppler shift and propagation delay model for NGSO. |
|  |  |
| ***Clauses affected:*** | 8.2, 8.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS 36.521-4  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

----------------------------------------------------- Beginning of Change 1 ------------------------------------------------------------

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 Annex C. The SNR requirement applies for the UE categories given for each test.

8.1.2 Applicability of requirements

8.1.2.1 Applicability of requirements for different channel bandwidths

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

8.1.2.2 Applicability of requirements for optional UE features

The performance requirements in Table 8.1.2.2-1 shall apply for UEs which support optional UE features only. If same test is listed for different UE features/capabilities in Clauses 8.1.2.2, then this test shall apply for UEs which support all corresponding UE features/capabilities.

For UEs supporting NTN access (*ntn-Connectivity-EPC-r17*), the requirements in TS36.101 [7] Clause 8 also apply with NTN configurations, e.g., including Ephemeris, K\_offset and NTN bands, according to the UE category and capability, as summarized in Table 8.1.2.2-2.

**Table 8.1.2.2-1: Requirements applicability for optional UE features**

|  |  |  |
| --- | --- | --- |
| **UE feature/capability** | **Test list** | **Applicability notes** |
| NTN access (ntn-Connectivity-EPC-r17) | Clause 8.2.1.1 (Test 1, Test 2, Test 3) | The requirements apply only for UE Category M1 |
| Clause 8.3.1.1 (Test 1, Test 2) | The requirements apply only for UE Category NB1, NB2 |
| NTN scenario support (ntn-ScenarioSupport-r17) | Clause 8.2.1.1 (Test 1, Test 2, Test 3) | The requirements apply only for UE Category M1, and only when ntn-ScenarioSupport-r17 is “ngso” or is not included |
| Clause 8.3.1.1 (Test 1, Test 2) | The requirements apply only for UE Category NB1, NB2, and only when ntn-ScenarioSupport-r17 is “ngso” or is not included |
| Operation in coverage enhancement mode A (ce-ModeA-r13) | Clause 8.2.1.1 (Test 1, Test 2) | The requirements apply only for UE Category M1 |
| Operation in coverage enhancement mode B (ce-ModeB-r13) | Clause 8.2.1.1 (Test 3) | The requirements apply only for UE Category M1 |
| Note: Void |

**Table 8.1.2.2-2: Requirements applicability combinations of TS 36.101 and TS 36.102**

|  |  |
| --- | --- |
|  | **Supported bands** |
| **ntn-ScenarioSupport-r17** | **Both TN and NTN bands** | **Only NTN bands** |
| gso (GSO only) | TS 36.101 Clause 8 & 9 (with TN configurations) | TS 36.101 Clause 8 (with NTN GSO configurations) |
| ngso (NGSO only) | TS 36.101 Clause 8 &.9 (with TN configurations)TS 36.102 Clause 8 (with NTN NGSO configurations) | TS 36.101 Clause 8 (with NTN NGSO configurations)TS 36.102 Clause 8 (with NTN NGSO configurations) |
| not included (Both GSO and NGSO) | TS 36.101 Clause 8 & 9 (with TN configurations)TS 36.102 Clause 8 (with NTN NGSO configurations) | TS 36.101 Clause 8 (with NTN GSO configurations)TS 36.102 Clause 8 (with NTN NGSO configurations) |

8.1.3 UE category and UE DL category

UE category and UE DL category refer to *ue-Category,* *ue-CategoryDL, and ue-Category-NB* define in 4.1, 4.1A and 4.1C from [11]. A UE that belongs to either a UE category or a UE DL category indicated in UE performance requirements in subclause 8 shall fulfil the corresponding requirements.

8.2 Demodulation performance requirements for UE category M1

The requirements for UE DL Category M1 in this sub-clause are defined based on the simulation results with UE DL Category M1 unless otherwise stated.

8.2.1 FDD and half-duplex FDD

8.2.1.1 PDSCH

The parameters specified in Table 8.2.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

**Table 8.2.1.1-1: Common Test Parameters (FDD and half-duplex FDD)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **CE Mode A**  | **CE Mode B** |
| Inter-TTI Distance |  | 1 | 1 |
| Number of HARQ processes per component carrier | Processes | 8 | 2 |
| Maximum number of HARQ transmission |  | 4 | 4 |
| Redundancy version coding sequence *rvidx* (Note 1) |  | {0, 2, 3, 1} for QPSK and 16QAM | {0,0,0,0,2,2,2,2,3,3,3,3,1,1,1,1…} for QPSK |
| Cyclic Prefix |  | Normal | Normal |
| Beamforming Precoder for MPDCCH  |  | N/A | N/A |
| BL/CE DL subframe configuration (fdd-DownlinkOrTddSubframeBitmapBR) |  | 1111111111 | 1111111111 |
| HARQ bundling(ce-HARQ-AckBundling) |  | Disabled | Disabled |
| Koffset (k-Offset) | ms | 8 | 8 |
| Note 1: *rvidx* is defined in TS 36.213 [12] Table 7.1.7.1-2. |

8.2.1.1.1 Single-antenna port performance

8.2.1.1.1.1 Minimum Requirements

The requirements are specified in Table 8.2.1.1.1.1-2 and Table 8.2.1.1.1.1-3, with the addition of the parameters in Table 8.2.1.1.1.1-1, and the downlink physical channel setup according to Annex B.3.2. The purpose is to verify the performance of single antenna port configuration.

**Table 8.2.1.1.1.1-1: Test Parameters for single antenna port (FRC)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1 and Test 4** | **Test 2 and Test 5** | **Test 3** |
| Downlink power allocation | $$ρ\_{A}$$ |  | -3 | -3 | -3 |
|  | $$ρ\_{B}$$ |  | -3 (Note 1) | -3 (Note 1) | -3 (Note 1) |
|  | $$σ$$ |  | 0 | 0 | 0 |
|  | $$δ$$ |  | 3 | 3 | 3 |
| $N\_{oc}$ at antenna port | dBm/15kHz | -98 | -98 | -98 |
| Coverage enhancement mode |  | CE Mode A | CE Mode A | CE Mode B |
| PDSCH transmission mode |  | 1 | 1 | 1 |
| OFDM starting symbol (startSymbolBR) |  | 2 | 2 | 2 |
| Maximum number of repetitions(for PDSCH (*pdsch-maxNumRepetitionCEmodeA/ pdsch-maxNumRepetitionCEmodeB*)) |  | Not configured | Not configured | Not configured |
| PDSCH repetition number |  | 1 | 8 | 64 |
| Frequency hopping(mpdcch-pdsch-HoppingConfig) |  | Disabled | Disabled | Disabled |
| Frequency hopping offset(mpdcch-pdsch-HoppingOffset) |  | N/A | N/A | N/A |
| Frequency hopping interval(interval-FDD) | ms | N/A | N/A | N/A |
| MPDCCH transmission duration(mPDCCH-NumRepetition) | ms | 1 | 8 | 64 |
| MPDCCH repetition number |  | 1 | 8 | 64 |
| Number of narrowbands for frequency hopping(mpdcch-pdsch-HoppingNB) |  | N/A | N/A | N/A |
| Starting subframe configuration for MPDCCH(mpdcch\_startSF\_UESS) |  | 1 | 4 | 2.5 |
| Narrowband for MPDCCH(mpdcch\_Narrowband) |  | 0 | 0 | 0 |
| MPDCCH aggregation level |  | 8 | 24 | 24 |
| Note 1: $P\_{B}=1$.Note 2: For each test, DC subcarrier puncturing shall be considered.Note 3: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [3] or/and TS 36.213 [12] as appropriate. |

**Table 8.2.1.1.1.1-2: Minimum performance for single antenna port (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 | 1.4MHz 16QAM 1/2 | R.1 FDD | OP.1 FDD | NTN-TDLC5-30 | 1x1 | 70 | 10.4 | M1 |
| 2 | 1.4MHz QPSK 1/3 | R.2 FDD | OP.1 FDD | NTN-TDLA100-200 | 1x1 | 70 | -4.2 | M1 |
| 3 | 1.4MHz QPSK 1/10 | R.3 FDD | OP.1 FDD | NTN-TDLA100-10 | 1x1 | 70 | -11.5 | M1 |

**Table 8.2.1.1.1.1-3: Minimum performance for single antenna port (FRC) with time-varying Doppler shift and propagation delay model**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | 1.4MHz 16QAM 1/2 | R.1 FDD | OP.1 FDD | NTN-TDLC5-30 | 1x1 | 70 | [11.4] | M1 |
| 5 | 1.4MHz QPSK 1/3 | R.2 FDD | OP.1 FDD | NTN-TDLA100-200 | 1x1 | 70 | [-3.2] | M1 |
| Note 1: The time-varying Doppler shift and propagation delay model, specified in Annex E, is applied. |

8.3 Demodulation performance requirements for UE category NB1 and NB2

8.3.1 Half-duplex FDD

8.3.1.1 NPDSCH demodulation requirements

The parameters specified in Table 8.3.1.1-1 and Table 8.3.1.1-2 are valid for all half-duplex FDD tests unless otherwise stated.

**Table 8.3.1.1-1: Common Test Parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Number of HARQ processes per component carrier | Processes | 1 |
| Maximum number of HARQ transmission |  | 4 |
| Cyclic Prefix |  | Normal |
| eutraControlRegionSize-r13 |  | N/A |
| downlinkBitmap-r13 and dl-Gap-r13 |  | Not configured |
| dl-GapNonAnchor-r13 anddownlinkBitmapNonAnchor-r13 |  | Not configured |
| Unused REs or RB |  | OCNG |
| OCNG pattern |  | NB.OP.1 |

**Table 8.3.1.1-2: Test Parameters of related NPDCCH and NPUSCH format 2 configurations**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| DCI format |  | DCI format N1 |
| scheduling delay field () |  | 1 |
| **(***ack-NACK-NumRepetitions-r13*) |  | 1 |
| ACK/NACK resource field |  | 0 |
| Reference channel for NPDCCH |  | R.NB.3 FDD |
| (*npdcch-Offset-USS-r13*) |  | 0 |
| K\_offset | ms | 8 |

8.3.1.1.1 Single-antenna port performance

8.3.1.1.1.1 Minimum Requirements for standalone operation and in-band operation in NR carrier

The requirements are specified in Table 8.3.1.1.1.1-2 and Table 8.3.1.1.1.1-3, with the addition of the parameters in Table 8.3.1.1.1.1-1 and the downlink physical channel setup according to Annex B.3.3. The purpose of these tests is to verify the performance.

Note: For the in-band requirement these apply to cases where there is no CRS and no control region under in-band operation.

**Table 8.3.1.1.1.1-1: Test Parameters for NPDSCH under Standalone and In-band Operations**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1, 2** |
| at antenna port |  | dBm/15kHz | -93 (Note 1) |
|  | dBm/15kHz | -99 (Note 2) |
| NPDCCH repetition number | subframe | 32 for Test 1 and Test 3; 128 for Test 2. |
| (*npdcch-NumRepetitions-r13*) | subframe | 64 for Test 1 and Test 3; 256 for Test 2. |
| (*nPDCCH-startSF-USS-r13*) |  | 1.5 |
| Note 1: This noise is applied to all subframes from the end of the NPDCCH to the end of the following NPDSCH transmission.Note 2: This noise is applied to all subframes from the end of the NPDSCH to the end of the following NPDCCH transmission. |

**Table 8.3.1.1.1.1-2: Minimum performance for NPDSCH under Standalone Operations and In-band Operations with 1 NRS port**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth** | **Carrier Type** | **Reference Channel** | **Repetition number** | **Propagation condition** | **Number of NRS ports** | **Antenna Configuration** | **Reference value** | **UE Category** |
| **Fraction of Maximum****Throughput (%)** | **SNR (dB)** |
| 1 | 200kHz | Anchor | R.NB.1 FDD | 32 | NTN-TDLC5-200 | 1 | 1x1 | 70% | -4.7 | NB1, NB2 |
| 2 | 200kHz | Non-anchor | R.NB.2 FDD | 128 | NTN-TDLA100-10 | 1 | 1x1 | 70% | -10.6 | NB1, NB2 |

**Table 8.3.1.1.1.1-3: Minimum performance for NPDSCH under Standalone Operations and In-band Operations with 1 NRS port with time-varying Doppler shift and propagation delay model**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth** | **Carrier Type** | **Reference Channel** | **Repetition number** | **Propagation condition** | **Number of NRS ports** | **Antenna Configuration** | **Reference value** | **UE Category** |
| **Fraction of Maximum****Throughput (%)** | **SNR (dB)** |
| 3 | 200kHz | Anchor | R.NB.1 FDD | 32 | NTN-TDLC5-200 | 1 | 1x1 | 70% | [-4.2] | NB1, NB2 |
| Note 1: The time-varying Doppler shift and propagation delay model, specified in Annex E, is applied. |

------------------------------------------------------------- End of change 1 ------------------------------------------------------------