**3GPP TSG- Meeting #**

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

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|  |
| ***Title:***  |  |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_NTN\_enh-Perf |  | ***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:*** | As per the WI schedule, several draft CRs were endorsed, this CR is used to merge all endorsed draft CRs to easy specification implementation. |
|  |  |
| ***Summary of change:*** | The merged draft CRs and corresponding changes are summarized as below:* R4-2409858
	+ Introduction of new general sections for clause 11 on radiated requirements
* R4-2409868
	+ For introducing NTN PDSCH demodulation requirements, add new clause 11.2.2.
* R4-2409862
	+ Introduced requirements for FR2 NTN for PDCCH demod
* R4-2410021
	+ Introduce new FRC for MCS4 and MCS13 with 200M BW and 120k SCS
* R4-2410012
	+ Add PDCCH reference measurement channel and NTN-TDLC5-1200 channel model for NR NTN enhancements
* R4-2407357 Draft CR to 38.101-5 for updates to Annex C
	+ Introduced updates to Annex C relevent to radiated requirements
* PDCCH performance requirements in Table 11.2.3.1.1-1 are updated as per the submitted simulation results summary R4-2408978
 |
|  |  |
| ***Consequences if not approved:*** | There will be NTN enhancements performance requirements in the specification:* R4-2409858
	+ Radiated requirements will not be introduced
* R4-2409868
	+ There will be inconsist between specification and RAN4 agreements
* R4-2409862
	+ There will be no requirements for PDCCH demod for FR2 NTN
* R4-2410021
	+ There is no proper FRC for the newly introduced FR2 NTN PDSCH performance requirements.
* R4-2410012
	+ Channel model and PDCCH reference measurement channel will remain undefined in the specfication
* R4-2407357
	+ There will be no Setup and Connection specified for radiated requirements
 |
|  |  |
| ***Clauses affected:*** | 11,11.1, 11.2, 11.2.2, 11.2.3, A.3.2.1, A.3.3, B.2.2,C.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-5 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | New clauses: 11, A.3.3,C.5 |
|  |  |
| ***This CR's revision history:*** |  |

====================== Start of Change#1 R4-2409858 =======================

# 11 Demodulation performance requirements (Radiated requirements)

## 11.1 General

### 11.1.2 Applicability of minimum requirements

The conducted minimum requirements specified in this specification shall be met in all applicable scenarios for FR2-NTN.

### 11.1.3 Conducted requirements

#### 11.1.3.1 Introduction

The requirements are defined for the following modes:

- Mode 1: Conditions with external noise source

- Wanted signal with power level Es is transmitted.

- External white noise source with power spectral density Noc is used.

- *Es* and *Noc* levels are selected to achieve target SNR as described in Clause 11.1.3.3.

#### 11.1.3.2 Reference point

The reference point for SNR, Es and Noc of DL signal is the UE antenna connector or connectors.

#### 11.1.3.3 SNR definition

For Mode 1 conditions UE demodulation and CSI requirements, the Minimum performance requirement in clause 7, 8, 9 and 10 are defined relative to the baseband SNR level SNRBB*.* The SNR at the reference point is defined as

 *SNR = SNRBB +* ***∆BB***

where **∆BB**is specified in clause 4.5.3.

The reference point SNR is defined as:

 $SNR=\frac{\sum\_{j=1}^{N\_{RX}}E\_{s}^{(j)}}{\sum\_{j=1}^{N\_{RX}}N\_{oc}^{(j)}}$

- NRX denotes the number of receiver reference points, and the super script receiver reference point *j*.

- The above SNR definition assumes that the REs are not precoded, and does not account for any gain which can be associated to the precoding operation.

- Unless otherwise stated, the SNR refers to the SSS wanted signal.

- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.

- The power ratio of other wanted signals to the SSS is defined in Clause C.3.1.

#### 11.1.3.4 Noc

##### 11.1.3.4.1 Introduction

This clause describes the Noc power level for Mode 1 conditions conducted testing of demodulation and CSI requirements.

##### 11.1.3.4.2 Noc for operating bands in FR2-NTN

Unless otherwise stated, a fixed Noc power level of -145 dBm/Hz shall be used for all operating bands.

## 11.2 Demodulation performance requirements

### 11.2.1 General

#### 11.2.1.1 Applicability of requirements

##### 11.2.1.1.1 General

The minimum performance requirements are applicable to all FR2-NTN operating bands defined in clause [5.3].

If same test is listed for different UE features/capabilities in Clauses 11.2.1.1.2, then this test shall apply for UEs which support all corresponding UE features/capabilities.

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

The performance requirements in Table 11.2.1.1.2-1 shall apply for UEs which support optional UE features only.

Table 11.2.1.1.2-1: Requirements applicability for optional UE features

|  |  |  |  |
| --- | --- | --- | --- |
| **UE feature/capability [TBD]** | **Test type** | **Test list** | **Applicability notes** |
| NR NTN access (nonTerrestrialNetwork-r17) | FR2-NTN | PDCCH | Clause 11.2.3.1.1.1 (Test 1-1, Test 1-2) |  |
| NR NTN scenario support (ntn-ScenarioSupport-r17) | FR2-NTN | PDSCH | Clause 11.2.2.1.1.1 (Test 2-1, Test 2-2, Test 2-3, Test 2-4) | The requirements apply only when *ntn-ScenarioSupport-r17* is “gso”  |
| FR2-NTN | PDSCH | Clause 11.2.2.1.1.1 (Test 1-1, Test 1-2, Test 1-3, Test 1-4) | The requirements apply only when *ntn-ScenarioSupport-r17* is “ngso” or is not configured. |
| Increasing the number of HARQ processes (max-HARQ-ProcessNumber-r17)  | FR2-NTN | PDSCH | Clause 11.2.1.2.2.1 (Test 1-3, 2-3) |  |
| Disabled HARQ feedback for downlink transmission (harq-FeedbackDisabled-r17)  | FR2-NTN | PDSCH | Clause 11.2.1.2.2.1 (Test 1-4, 2-4) |  |

====================== End of Change#1 R4-2409858 =======================

====================== Start of Change#1 R4-2409868 =======================

### 11.2.2 PDSCH demodulation requirements

The parameters specified in Table 11.2.2-1 are valid for all PDSCH tests unless otherwise stated.

**Table 11.2.2-1: Common test parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| PDSCH transmission scheme |  | Transmission scheme 1 |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | RBs | 0 |
| Subcarrier spacing | kHz | 120 |
| DL BWP configuration #1 | Cyclic prefix |  | Normal |
| RB offset | RBs | 0 |
| Number of contiguous PRB | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [15] for tested channel bandwidth and subcarrier spacing |
| Common serving cell parameters | Physical Cell ID |  | 0 |
| SSB position in burst |  | First SSB in Slot #0 |
| SSB periodicity | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot |
| Symbols with PDCCH | Symbols | 0 |
| Number of PRBs in CORESET |  | Table 7.2-2 of 38.101-4 for tested channel bandwidth and subcarrier spacing |
| Number of PDCCH candidates and aggregation levels |  | 1/AL8 |
| CCE-to-REG mapping type |  | Non-interleaved |
| DCI format |  | 1\_1 |
| TCI state |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration |  | No precoding |
| Cross carrier scheduling |  | Not configured |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS  |  | k0=0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS  |  |  l0 = 6 for CSI-RS resource 1 and 3l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type |  | 'No CDM’ for CSI-RS resource 1,2,3,4 |
| Density (ρ) |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | Slots | 160 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 80 for CSI-RS resource 1 and 281 for CSI-RS resource 3 and 4 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4)\*4 |
| QCL info |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Row index (Note 3) |  | 3 for 2 CSI-RS ports and 5 for 4 CSI-RS ports |
| First subcarrier index in the PRB used for CSI-RS  |  | k0 = 0 |
| First OFDM symbol in the PRB used for CSI-RS  |  | l0 = 12 |
| Number of CSI-RS ports (X) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 1 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4)\*4 |
| QCL info |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Row index (Note 3) |  | 5 |
| First subcarrier index in the PRB used for CSI-RS  |  | k0 = 4 |
| First OFDM symbol in the PRB used for CSI-RS  |  | l0 = 12 |
| Number of CSI-RS ports (X) |  | 4 |
| CDM Type |  | 'FD-CDM2' |
| Density (ρ) |  | 1 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 0 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4)\*4 |
| ZP CSI-RS for CSI acquisition | First subcarrier index in the PRB used for CSI-RS  |  | k0 = 0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS  |  | l0 = 8 for CSI-RS resource 1l0 = 9 for CSI-RS resource 2 |
| Number of CSI-RS ports (X) |  | 1 for CSI-RS resource 1,2 |
| CDM Type |  | 'No CDM' for CSI-RS resource 1,2 |
| Density (ρ) |  | 3 for CSI-RS resource 1,2 |
| CSI-RS periodicity | Slots | 160 for CSI-RS resource 1,2 |
| CSI-RS offset | Slots | 0 for CSI-RS resource 1,2 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4)\*4 |
| Repetition  |  | ON |
| QCL info  |  | TCI state #1 |
| PDSCH DMRS configuration | Antenna ports indexes |  | {1000} for Rank 1 tests |
| Position of the first DMRS for PDSCH mapping type A |  | 2 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 for Rank 1 |
| TCI state #0 | Type 1 QCL information  | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information  | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PT-RS configuration |  | Not configured |
| Maximum number of code block groups for ACK/NACK feedback |  | 1 |
| Maximum number of HARQ transmission |  | 4 |
| HARQ ACK/NACK bundling |  | Not configured |
| Redundancy version coding sequence |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration |  | No precoding |
| Symbols for all unused REs |  | OP.1 FDD as defined in Annex A.5.1.1 of 38.101-4 |
| Physical signals, channels mapping and precoding |  | As specified in Annex B.4.1 of 38.101-4 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [15] for tested channel bandwidth and subcarrier spacing.Note 3: Refer to Table 7.4.1.5.3-1 in [9] |

#### 11.2.2.1 1Rx requirements

##### 11.2.2.1.1 FDD

###### 11.2.2.1.1.1 Minimum requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 11.2.2.1.1.1-3 with the addition of test parameters in Table 11.2.2.1.1.1-2 and the downlink physical channel setup according to Annex A.3.

The test purposes are specified in Table 11.2.2.1.1.1-1.

**Table 11.2.2.1.1.1-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models and MCS | 1-1, 1-2, 1-3, 1-4 |

**Table 11.2.2.1.1.1-2: Test parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | FDD |
| Active DL BWP index |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S)  |  | 1 |
| Length (L) |  | 13 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | 160 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 80 for CSI-RS resource 1 and 281 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes |  | 16 for Test 1-1, Test 1-232 for Test 1-34 with feedback disabled, 12 with feedback enabled in 16 HARQ processes for Test 1-4 in which 4 disabled processes are randomly selected at test configuration |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 80 for Test 1-1, Test 1-2, Test 1-3 and Test 1-42080 for Test 2-1, Test 2-2, Test 2-3 and Test 2-4 |
| Maximum number of HARQ transmission |  | 4 for Test 1-1, Test 1-2, Test 1-31 for Test 1-4 (re-Tx disabled for all HARQ processes) |

**Table 11.2.2.1.1.1-3: Minimum performance for Rank 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.3-3.1 FDD | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [3.5] |
| 1-2 | R.PDSCH.3-4.1 FDD | 200 / 120 | 16QAM, 0.48 | NTN-TDLC5-1200 | 1x1 | 70 | [11.2] |
| 1-3 | R.PDSCH.3-3.1 FDD | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [3.5] |
| 1-4 | R.PDSCH.3-3.1 FDD (Note 1) | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [4.2] |
| Note1: The Maximum throughput is based on the HARQ processes with HARQ feedback enabled. |

**Table 11.2.2.1.1.1-4: Minimum performance for Rank 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 2-1 | R.PDSCH.3-3.1 FDD | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [3.5] |
| 2-2 | R.PDSCH.3-4.1 FDD | 200 / 120 | 16QAM, 0.48 | NTN-TDLC5-1200 | 1x1 | 70 | [11.2] |
| 2-3 | R.PDSCH.3-3.1 FDD | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [3.5] |
| 2-4 | R.PDSCH.3-3.1 FDD (Note 1) | 200 / 120 | QPSK, 0.30 | NTN-TDLC5-1200 | 1x1 | 70 | [4.2] |
| Note1: The Maximum throughput is based on the HARQ processes with HARQ feedback enabled. |

====================== End of Change#1 R4-2409868 =======================

====================== Start of Change#1 R4-2409862 =======================

11.2.3 PDCCH demodulation requirements

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

The parameters specified in Table 11.2.3-1 are valid for all PDCCH tests unless otherwise stated.

**Table 11.2.3-1: Common test Parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) |  | 0 |
| DL BWP configuration #1 | Cyclic prefix |  | Normal |
| Common serving cell parameters | Physical Cell ID |  | 0 |
| SSB position in burst |  | First SSB in Slot #0 |
| SSB periodicity | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (k0) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | CSI-RS resource 1: 4CSI-RS resource 2: 8CSI-RS resource 3: 4CSI-RS resource 4: 8 |
| Number of CSI-RS ports (X) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 3 |
| CSI-RS periodicity | Slots | 160 |
| CSI-RS offset | Slots | 80 for CSI-RS resource 1 and 281 for CSI-RS resource 3 and 4 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4)\*4 |
| QCL info |  | TCI state #0 |
| NZP CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS (k0) |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | CSI-RS resource 1: 8CSI-RS resource 2: 9 |
| Number of CSI-RS ports (X) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 3 |
| CSI-RS periodicity | Slots | 120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | Slots | 0 for CSI-RS resource 1,2 |
| Frequency Occupation |  | Start PRB 0Number of PRB = ceil(BWP size/4) \*4 |
| Repetition |  | ON |
| QCL info |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration |  | For number of TX = 1: No precoding;For number of TX > 1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebookindex, chosen from section 5.2.2.2.1 of TS 38.214 [12]. |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Symbols for all unused REs |  | OP.1 FDD as defined in Annex A.5.1.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 2 |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.Note 2: The high layer parameter *precoderGranularity* equals to *sameAsREG-bundle* as defined in clause 7.4.1.3 of TS 38.211 [9] |

11.2.3.1 1RX requirements

The parameters specified in Table 11.2.3.1-1 are valid for all PDCCH requirements unless otherwise stated.

**Table 11.2.3.1-1: Test Parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| CCE to REG mapping type |  | Interleaved |
| REG bundle size  |  | 2  |
| Interleaver size |  | 3  |
| Shift index |  | 0 |

11.2.3.1.1 Minimum requirements with 1Tx Antenna

For the parameters specified in Table 11.2.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 11.2.3.1.1-1. The downlink physical setup is in accordance with Annex C.5.1.

**Table 11.2.3.1.1-1: Minimum performance requirements with 1 Tx Antenna**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth (MHz)** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** |
| **Pm-dsg (%)** | **SNRBB (dB)** |
| 1-1 | 200  | 132 | 1 | 8 | R.PDCCH.x1 | NTN-TDLC5-1200 | 1x1 Low | 1 | [4.6] |
| 1-2 | 200  | 132 | 2 | 16  | R.PDCCH.x2 | NTN-TDLC5-1200 | 1x1 Low | 1 | [3.2] |

====================== End of Change#1 R4-2409862 =======================

====================== Start of Change#1 R4-2410021 =======================

## A.3.2 Reference measurement channels for PDSCH performance requirements

For PDSCH reference channels if more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

### A.3.2.1 FDD

*<Unchanged Sections Skipped>*

#### A.3.2.1.3 Reference measurement channels for SCS 120 kHz FR2-NTN

[Editor note: The values in Table 3.2.1.2-1, 3.2.1.2-2, 3.2.1.3-1, and 3.2.1.3-2 may need to be changed.]

*<Unchanged Sections Skipped>*

Table A.3.2.1.3-3: PDSCH Reference Channel for FDD (QPSK)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.PDSCH.3-3.1 FDD  |  |  |  |  |
| Channel bandwidth | MHz | 200 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Number of allocated resource blocks | PRBs | 132 |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 13 |  |  |  |  |
| Allocated slots per 2 frames | Slots | 159 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 4 |  |  |  |  |
| Modulation |  | QPSK |  |  |  |  |
| Target Coding Rate |  | 0.30 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | Bits | 11528 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | CBs | 2 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 80, 81 | Bits | 36432 |  |  |  |  |
|  For Slots i =1,…, 79, 82, …, 159 | Bits | 38016 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 91.648 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

Table A.3.2.1.3-4: PDSCH Reference Channel for FDD (16QAM)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.PDSCH.3-4.1 FDD |  |  |  |  |
| Channel bandwidth | MHz | 200 |  |  |  |  |
| Subcarrier spacing | kHz | 120 |  |  |  |  |
| Number of allocated resource blocks | PRBs | 132 |  |  |  |  |
| Number of consecutive PDSCH symbols |  | 13 |  |  |  |  |
| Allocated slots per 2 frames | Slots | 159 |  |  |  |  |
| MCS table |  | 64QAM |  |  |  |  |
| MCS index |  | 13 |  |  |  |  |
| Modulation |  | 16QAM |  |  |  |  |
| Target Coding Rate |  | 0.48 |  |  |  |  |
| Number of MIMO layers |  | 1 |  |  |  |  |
| Number of DMRS REs |  | 12 |  |  |  |  |
| Overhead for TBS determination |  | 0 |  |  |  |  |
| Information Bit Payload per Slot  |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | Bits | 36896 |  |  |  |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | Bits | 24 |  |  |  |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | CBs | N/A |  |  |  |  |
|  For Slots i = 1,…, 159 | CBs | 5 |  |  |  |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
|  For Slot i = 0 | Bits | N/A |  |  |  |  |
|  For Slots i = 80, 81 | Bits | 72864 |  |  |  |  |
|  For Slots i =1,…, 79, 82, …, 159 | Bits | 76032 |  |  |  |  |
| Max. Throughput averaged over 2 frames | Mbps | 293.323 |  |  |  |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 msNote 2: Slot i is slot index per 2 frames |

====================== End of Change#1 R4-2410021 =======================

====================== Start of Change#1 R4-2410012 =======================

**--- Start of change 1 ---**

## A.3.3 Reference measurement channels for PDCCH performance requirements

### A.3.3.1 FDD

#### A.3.3.1.1 Reference measurement channels for SCS 120 kHz FR2-NTN

Table A.3.3.1.1-1: PDCCH Reference Channels

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Reference channel |  | R.PDCCH.1-1.1 FDD | R.PDCCH.1-1.2 FDD |
| Subcarrier spacing | kHz | 120 | 120 |
| CORESET frequency domain allocation |  | 132 | 132 |
| CORESET time domain allocation |  | 1 | 2 |
| Aggregation level |  | 8 | 16 |
| DCI Format |  | 1\_0 | 1\_1 |
| Payload (without CRC) | Bits | 42 | 56 |

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

**--- Start of change 2 ---**

## B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as a combination of a channel model name and a maximum Doppler frequency, i.e., NTN-TDLA<DS>-<Doppler>, or NTN-TDLC<DS>-<Doppler> where '<DS>' indicates the desired delay spread and '<Doppler>' indicates the maximum Doppler frequency (Hz).

Table B.2.2-1 show the propagation conditions that are used for the performance measurements in multi-path fading environment for NLOS and LOS propagation conditions.

Table B.2.2-1: Channel model parameters for NTN

|  |  |  |
| --- | --- | --- |
| Combination name | Model | Maximum Doppler frequency |
| NTN-TDLA100-200 | NTN-TDLA100 | 200 Hz |
| NTN-TDLC5-200 | NTN-TDLC5 | 200 Hz |
| NTN-TDLC5-1200 | NTN-TDLC5 | 1200Hz |

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

====================== End of Change#1 R4-2410012 =======================

====================== Start of Change#1 R4-2407357 =======================

C.4 Setup (Radiated)

Table C.4-1 describes the downlink Physical Channels that are required for connection set up.

**Table C.4-1: Downlink Physical Channels required for connection set-up**

|  |
| --- |
| **Physical Channel** |
| PBCH |
| SSS  |
| PSS |
| PDCCH |
| PDSCH |
| PBCH DMRS |
| PDCCH DMRS |
| PDSCH DMRS |
| CSI-RS  |
| PTRS |

C.5 Connection (Radiated)

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.5.1 Measurement of Receiver Characteristics

Table C.5.1-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

**Table C.5.1-1: Downlink Physical Channels transmitted during a connection (TDD)**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value (Note 2)** |
| SSS transmit power  | W | Test specific |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH to SSS | dB | 0 |
| EPRE ratio of PBCH to PBCH DMRS | dB | 0 |
| EPRE ratio of PDCCH to SSS | dB | 0 |
| EPRE ratio of PDCCH to PDCCH DMRS | dB | 0 |
| EPRE ratio of PDSCH to SSS | dB | 0 |
| EPRE ratio of PDSCH to PDSCH DMRS | dB | Test specific (Note 1) |
| EPRE ratio of CSI-RS to SSS | dB | -10\*log10(L) (Note 3) |
| EPRE ratio of PTRS to PDSCH | dB | Test specific |
| EPRE ratio of OCNG to SSS | dB | 0 |
| EPRE ratio of PDCCH OCNG to SSS | dB | 0 |
| Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on "Number of DM-RS CDM groups without data" and "DMRS Type" parameters specified for each test. Note 2: The value is the energy of per RE for a single antenna port before pre-coding.Note 3:  is the CDM group size of NZP CSI-RS specified for each test.Note 4: Value is derived from Table 4.1-2 in TS 38.214 [12] based on “The number of PDSCH layers” and “*epre-Ratio*” parameters specified for each test. |

====================== End of Change#1 R4-2407357 =======================