**3GPP TSG-RAN4 Meeting #97-e *R4-2017501***

**Online, , 2nd Nov 2020 - 13th Nov 2020**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.141-1** | **CR** | **0156** | **rev** | **1** | **Current version:** | **16.5.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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 |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Test requirements for 0.001% BLER | | | | | | | | | |
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| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_L1enh\_URLLC-Perf | | | | |  | ***Date:*** | | | 2020-10-23 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This CR to introduce URLLC into the performance specifications is created according to the CR work split agreed at RAN4#95-e. The following areas are covered:   * Requirements/Measurement of Performance requirements * Annex C.3 / Measurement system set-up Annex D (for 0.001% BLER) | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * New performance requirements section including methodology * Test requirement section for the 0.001% BLER test introduced * Annex C.3 Updated to include “X” factor * Minor updates to Annex D | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Incomplete introduction of URLLC | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.2.6, C.3, D.5.3, D.6.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS/TR 38.104 CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS/TR 38.141-2 CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### 8.2.6 Performance requirements for PUSCH with 0.001% BLER

#### 8.2.6.1 Definition and applicability

The performance requirement of PUSCH is determined by a maximum required transport block error rate (BLER) for a given SNR. The required BLER is defined as the probability of incorrectly decoding the transport block after reaching the maximum number of HARQ transmissions for the FRCs listed in annex A.

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.1.

#### 8.2.6.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 8.2.6.2.

#### 8.2.6.3 Test Purpose

The test shall verify the receiver's ability to achieve 0.001% BLER under AWGN conditions for a given SNR.

#### 8.2.6.4 Method of test

##### 8.2.6.4.1 Initial Conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier: M; see clause 4.9.1.

RF channels to be tested for carrier aggregation: MBW Channel CA; see clause 4.9.1.

##### 8.2.6.4.2 Procedure

1) Connect the BS tester generating the wanted signal and AWGN generators to all BS antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6 for *BS type 1-C* and *type 1-H* respectively.

2) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.6.4.2-1.

Table 8.2.6.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 kHz | 5 | -86.5 dBm / 4.5MHz |
| 10 | -83.3 dBm / 9.36MHz |
| 30 kHz | 10 | -83.6 dBm / 8.64MHz |
| 40 | -77.2 dBm / 38.16MHz |

3) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A and the test parameters in table 8.2.6.4.2-2.

Table 8.2.6.4.2-2: Test parameters for testing PUSCH with 0.001% BLER

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern (Note 1) | | 15 kHz SCS:  3D1S1U, S=10D:2G:2U  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 1 |
| RV sequence | 0 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS position | Pos1 |
| Number of DM-RS CDM group(s) without data | 1 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port(s) | {0} |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain resource assignment | PUSCH mapping type | A, B |
| Start symbol | 0 |
| Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |
| Note 1: The same requirements are applicable to FDD and TDD with different UL-DL patterns. | | |

4) No multipath fading channel is included in the test.

5) Adjust the equipment so that required SNR specified in table 8.2.6.5-1 to 8.2.6.5-8 is achieved at the BS input.

6) For each of the reference channels in table 8.2.6.5-1 to 8.2.6.5-8 applicable for the base station, measure the BLER. BLER is evaluated based on the test methodology described in Annex I.

#### 8.2.6.5 Test Requirement

The BLER according to clause 8.2.6.4.2 shall not be below the limits for the SNR levels specified in table 8.2.6.5-1 to 8.2.6.5-8.

Table 8.2.6.5-1: Test requirements for PUSCH with 0.001% BLER, Type A, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-1 | Pos1 | -3.8 |

Table 8.2.6.5-2: Test requirements for PUSCH with 0.001% BLER, Type A, 10 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-2 | Pos1 | -4.6 |

Table 8.2.6.5-3: Test requirements for PUSCH with 0.001% BLER, Type A, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-3 | Pos1 | -4.1 |

Table 8.2.6.5-4: Test requirements for PUSCH with 0.001% BLER, Type A, 40 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-4 | Pos1 | -4.9 |

Table 8.2.6.5-5: Test requirements for PUSCH with 0.001% BLER, Type B, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-1 | Pos1 | -3.9 |

Table 8.2.6.5-6: Test requirements for PUSCH with 0.001% BLER, Type B, 10 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-2 | Pos1 | -4.6 |

Table 8.2.6.5-7: Test requirements for PUSCH with 0.001% BLER, Type B, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A3A-3 | Pos1 | -4.2 |

Table 8.2.x.5-8: Test requirements for PUSCH with 0.001% BLER, Type B, 40 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions | BLER | FRC (annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | AWGN | 0.001% | G-FR1-A2A-4 | Pos1 | -4.9 |

# C.3 Measurement of performance requirements

Table C.3-1: Derivation of Test Requirements (Performance tests)

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Minimum Requirement in TS 38.104 [2] | Test Tolerance (TT) | Test requirement in the present document |
| 8.2.1 Performance requirements for PUSCH with transform precoding disabled | SNRs as specified | 0.6 dB for 1Tx cases  0.8 dB for 2Tx cases | Formula: SNR + TT  T-put limit unchanged |
| 8.2.1.6 Performance requirements for PUSCH with 0.001% BLER | SNRs as specified | 0.3 dB | Formula: SNR + TT + 1dB  1dB is added to the test requirement to facilitate early test pass. The BLER delivered by the device during the test will be lower than the test requirement, which enables compliance to the requirement to be demonstrated with a number of observed block errors lower than a certain threshold. |
| 8.2.2 Performance requirements for PUSCH with transform precoding enabled | SNRs as specified | 0.6 dB | Formula: SNR + TT  T-put limit unchanged |
| 8.2.3 Performance requirements for UCI multiplexed on PUSCH | SNRs as specified | 0.6 dB | Formula: SNR + TT  BLER limit unchanged |
| 8.2.4 Performance requirements for PUSCH for high speed train | SNRs as specified | 0.3 dB | Formula: SNR + TT  T-put limit unchanged |
| 8.3.1 Performance requirements for PUCCH format 0 | SNRs as specified | 0.6 dB | Formula: SNR + TT  False ACK limit unchanged  Correct ACK limit unchanged |
| 8.3.2 Performance requirements for PUCCH format 1 | SNRs as specified | 0.6 dB | Formula: SNR + TT  False ACK limit unchanged  False NACK limit unchanged  Correct ACK limit unchanged |
| 8.3.3 Performance requirements for PUCCH format 2 | SNRs as specified | 0.6 dB | Formula: SNR + TT  False ACK limit unchanged  Correct ACK limit unchanged  UCI BLER limit unchanged |
| 8.3.4 Performance requirements for PUCCH format 3 | SNRs as specified | 0.6 dB | Formula: SNR + TT  UCI BLER limit unchanged |
| 8.3.5 Performance requirements for PUCCH format 4 | SNRs as specified | 0.6 dB | Formula: SNR + TT  UCI BLER limit unchanged |
| 8.3.6 Performance requirements for multi-slot PUCCH | SNRs as specified | 0.6 dB | Formula: SNR + TT  False ACK limit unchanged  False NACK limit unchanged  Correct ACK limit unchanged |
| 8.4.1 PRACH false alarm probability and missed detection | SNRs as specified | 0.6 dB for fading cases  0.3 dB for AWGN cases | Formula: SNR + TT  PRACH false detection limit unchanged  PRACH detection limit unchanged |

## D.5.3 Performance requirements for PUSCH and PRACH in static conditions



Figure D.5.3-1: Functional set-up for performance requirements for PUSCH and PRACH in static conditions for BS with Rx diversity (2 Rx case shown)

## D.6.3 Performance requirements for PUSCH and PRACH in static conditions



Figure D.6.3-1: Functional set-up for performance requirements for PUSCH and PRACH in static conditions for BS with Rx diversity (2 Rx case shown)