**3GPP TSG- Meeting #**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  |  | **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:***  | CR to TS 38.101-4: Performance requirements for URLLC High BLER feature tests |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | New feature of PDSCH URLLC feature test requirements including:* Test case for pre-emption indication for FR1
* FR2 Type B requirements
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|  |  |
| ***Summary of change:*** | For minimum requirements:* Pre-emption add new section 5.2.2 and section 5.2.3
* FR2 Type B add new section 7.2.2
 |
|  |  |
| ***Consequences if not approved:*** | New demodulation requirements cannot be verified for:* PDSCH pre-emption
* FR2 Type B mapping
 |
|  |  |
| ***Clauses affected:*** | 5.2.2, 5.2.3, 7.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.521-4  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | R4-2016106 |

*<Start of the change 1>*

##### 5.2.2.1.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.2.1.8-3, with the addition of test parameters in Table 5.2.2.1.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.8-1.

Table 5.2.2.1.8-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH pre-emption performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.1.8-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | FDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S)  |  | 2 |
| Length (L) |  | 12 |
| 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 |
| Pre-emption configuration (Note 1, 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset (Note 3) |  | TBD 10/1 or (10,11)/1 |
| Number of HARQ Processes |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 2 |
| Note 1: If UE cannot decode PDSCH correctly upon receiving PI on PDCCH with DCI format 2\_1, UE feeds back NACK to gNB. Then UE flushes the buffer and waits for the next re-transmission for LLR combining to decode the PDSCH.Note 2: Interference modelled as random data on pre-empted REs.Note 3: Pre-emption is scheduled with a fixed scheduling with 10 or 20% probability within 10ms periodicityNote 4: In addition to PDCCH configuration in Table 5.2-1 |

Table 5.2.2.1.8-3: 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.x FDD | 10 / 15 | TBD | TDLA30-10 | 2x2, ULA Low | TBD | TBD |

*<End of the change 1>*

*<Start of the change 2>*

##### 5.2.2.2.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.2.2.8-3, with the addition of test parameters in Table 5.2.2.2.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.8-1.

Table 5.2.2.2.8-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH pre-emption performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.2.8-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S)  |  | 2 |
| Length (L) |  | 12 |
| 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 |
| Pre-emption configuration (Note 1, 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset (Note 3) |  | TBD 10/1 or (10,11)/1 |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | FR1.30-1 |
| Note 1: If UE cannot decode PDSCH correctly upon receiving PI on PDCCH with DCI format 2\_1, UE feeds back NACK to gNB. Then UE flushes the buffer and waits for the next re-transmission for LLR combining to decode the PDSCH.Note 2: Interference modelled as random data on pre-empted REs.Note 3: Pre-emption is scheduled with a fixed scheduling with 10 or 20% probability within 10ms periodicityNote 4: In addition to PDCCH configuration in Table 5.2-1 |

Table 5.2.2.2.6-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.x TDD | 40 / 30 | TBD | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | TBD | TBD |

*<End of the change 2>*

*<Start of the change 3>*

##### 5.2.3.1.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.3.1.8-3, with the addition of test parameters in Table 5.2.3.1.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.8-1.

Table 5.2.3.1.8-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH pre-emption performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.1.8-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | FDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S)  |  | 2 |
| Length (L) |  | 12 |
| 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 |
| Pre-emption configuration (Note 1, 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset (Note 3) |  | TBD 10/1 or (10,11)/1 |
| Number of HARQ Processes |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | 2 |
| Note 1: If UE cannot decode PDSCH correctly upon receiving PI on PDCCH with DCI format 2\_1, UE feeds back NACK to gNB. Then UE flushes the buffer and waits for the next re-transmission for LLR combining to decode the PDSCH.Note 2: Interference modelled as random data on pre-empted REs.Note 3: Pre-emption is scheduled with a fixed scheduling with 10 or 20% probability within 10ms periodicityNote 4: In addition to PDCCH configuration in Table 5.2-1 |

Table 5.2.3.1.8-3: 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.x FDD | 10 / 15 | TBD | TDLA30-10 | 2x4, ULA Low | TBD | TBD |

*<End of the change 3>*

*<Start of the change 4>*

##### 5.2.3.2.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.3.2.8-3, with the addition of test parameters in Table 5.2.3.2.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.8-1.

Table 5.2.3.2.8-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH pre-emption performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.2.8-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S)  |  | 2 |
| Length (L) |  | 12 |
| 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 |
| Pre-emption configuration (Note 1, 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset (Note 3) |  | TBD 10/1 or (10,11)/1 |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | FR1.30-1 |
| Note 1: If UE cannot decode PDSCH correctly upon receiving PI on PDCCH with DCI format 2\_1, UE feeds back NACK to gNB. Then UE flushes the buffer and waits for the next re-transmission for LLR combining to decode the PDSCH.Note 2: Interference modelled as random data on pre-empted REs.Note 3: Pre-emption is scheduled with a fixed scheduling with 10 or 20% probability within 10ms periodicityNote 4: In addition to PDCCH configuration in Table 5.2-1 |

Table 5.2.3.2.8-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.x TDD | 40 / 30 | TBD | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | TBD | TBD |

*<End of the change 4>*

*<Start of the change 5>*

##### 7.2.2.2.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 7.2.2.2.2-3, with the addition of test parameters in Table 7.2.2.2.2-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type B scheduling.

The test purposes are specified in Table 7.2.2.2.2-1.

Table 7.2.2.2.2-1: Test purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH mapping Type B performance under 2 receive antenna conditions | 1-1 |

Table 7.2.2.2.2-2: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Duplex mode |  | TDD |
| Active DL BWP index |  | 1 |
| PDCCH configuration | Number of PDCCH candidates and aggregation levels |  | 1/AL8 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S)  |  | 1 |
| Length (L) |  | 2 |
| 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 |  | 0 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.3 |

Table 7.2.2.2.2-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation****condition** | **Correlation matrix and antenna configuration** | **Reference value** |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.x TDD | 100 / 120 | [QPSK, 0.30] | FR2.120-1 | [TDLA30-75] | 2x2, ULA Low | 70 | TBD |

*<End of the change 5>*