**3GPP TSG- Meeting # *draft***

**, , -**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***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 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:*** | | Agreement in RAN4#96-e to introduce multi-path fading channel requirements with high Doppler value in a separate table under section “8.2.4 Requirements for PUSCH for high speed train”.  Update of SNR requirements following simulation collection [R4-2012749]. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce multi-path fading channel requirements with high Doppler value in a separate table under section “8.2.4 Requirements for PUSCH for high speed train”.  Replacemnt of TBDs in SNR requirements following simulation collection.  Addition of newly used combinations of channel model parameters. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | HST performance cannot be guaranteed in multipath fading scenarios with high Doppler values.  HST PUSCH SNR values not present, i.e., not testable. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.2.4.2, G.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.141-1, TS 38.141-2 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | Submitted to AI: 7.15.3.2.1 | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R4-2015091 | | | | | | | | |

**<<Start of first change>>**

#### 8.2.4.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 8.2.4.2-1 to 8.2.4.2-10 at the given SNR for 1Tx. FRCs are defined in annex A. Unless stated otherwise, the MIMO correlation matrices for the gNB are defined in annex G for low correlation.

Table 8.2.4.2-1: Minimum requirements for PUSCH, Type A, 10 MHz channel bandwidth, 15 kHz SCS, 350km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-33 | pos2 | [-0.8] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-33 | pos2 | -3.7 |
|  | 2 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-29 | pos2 | 8.4 |
| 1 |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-33 | pos2 | -3.6 |
|  |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A4-29 | pos2 | 8.7 |
|  | 8 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-33 | pos2 | -9.2 |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-29 | pos2 | 2.6 |

Table 8.2.4.2-2: Minimum requirements for PUSCH, Type A, 40 MHz channel bandwidth, 30 kHz SCS, 350km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-34 | pos2 | [-0.6] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-34 | pos2 | -3.7 |
|  | 2 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-30 | pos2 | 8.5 |
| 1 |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-34 | pos2 | -3.6 |
|  |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A4-30 | pos2 | 8.7 |
|  | 8 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-34 | pos2 | -9.1 |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-30 | pos2 | 2.7 |

Table 8.2.4.2-3: Minimum requirements for PUSCH, Type A, 10 MHz channel bandwidth, 15 kHz SCS, 500km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-33 | pos2 | [-0.7] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-33 | pos2 | -3.9 |
|  | 2 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-29 | pos2 | 8.5 |
| 1 |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-33 | pos2 | -3.6 |
|  |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A4-29 | pos2 | 9.2 |
|  | 8 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-33 | pos2 | -9.4 |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-29 | pos2 | 2.7 |

Table 8.2.4.2-4: Minimum requirements for PUSCH, Type A, 40 MHz channel bandwidth, 30 kHz SCS, 500km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-34 | pos2 | [-0.5] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-34 | pos2 | -3.9 |
|  | 2 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-30 | pos2 | 8.7 |
| 1 |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-34 | pos2 | -3.6 |
|  |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A4-30 | pos2 | 8.0 |
|  | 8 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-34 | pos2 | -9.2 |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-30 | pos2 | 2.8 |

Table 8.2.4.2-5: Minimum requirements for PUSCH, Type A, 5 MHz channel bandwidth, 15 kHz SCS, 350km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-33A | pos2 | [-0.7] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-33A | pos2 | [-3.7] |
|  | 2 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-29A | pos2 | [8.5] |
| 1 |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-33A | pos2 | [-3.6] |
|  |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A4-29A | pos2 | [8.5] |
|  | 8 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-33A | pos2 | [-9.1] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-29A | pos2 | [2.8] |

Table 8.2.4.2-6: Minimum requirements for PUSCH, Type A, 10 MHz channel bandwidth, 30 kHz SCS, 350km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-34A | pos2 | [-0.7] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-34A | pos2 | [-3.6] |
|  | 2 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-30A | pos2 | [8.3] |
| 1 |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A3-34A | pos2 | [-3.6] |
|  |  | Normal | HST Scenario 3-NR350 | 70 % | G-FR1-A4-30A | pos2 | [8.6] |
|  | 8 | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A3-34A | pos2 | [-9.0] |
|  |  | Normal | HST Scenario 1-NR350 | 70 % | G-FR1-A4-30A | pos2 | [2.6] |

Table 8.2.4.2-7: Minimum requirements for PUSCH, Type A, 5 MHz channel bandwidth, 15 kHz SCS, 500km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-33A | pos2 | [-0.6] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-33A | pos2 | [-3.6] |
|  | 2 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-29A | pos2 | [8.7] |
| 1 |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-33A | pos2 | [-3.5] |
|  |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A4-29A | pos2 | [8.8] |
|  | 8 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-33A | pos2 | [-9.1] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-29A | pos2 | [3.0] |

Table 8.2.4.2-8: Minimum requirements for PUSCH, Type A, 10 MHz channel bandwidth, 30 kHz SCS, 500km/h

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
|  | 1 | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-34A | pos2 | [-0.5] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-34A | pos2 | [-3.6] |
|  | 2 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-30A | pos2 | [8.6] |
| 1 |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A3-34A | pos2 | [-3.4] |
|  |  | Normal | HST Scenario 3-NR500 | 70 % | G-FR1-A4-30A | pos2 | [8.4] |
|  | 8 | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A3-34A | pos2 | [-8.8] |
|  |  | Normal | HST Scenario 1-NR500 | 70 % | G-FR1-A4-30A | pos2 | [2.9] |

Table 8.2.4.2-9: Minimum requirements for PUSCH, Type A, 5 MHz channel bandwidth, 15 kHz SCS, 500km/h, multi-path fading channel requirements with high Doppler value

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLC300-600 | 70 % | G-FR1-A3-33A | pos2 | [-1.9] |

Table 8.2.4.2-10: Minimum requirements for PUSCH, Type A, 10 MHz channel bandwidth, 30 kHz SCS, 500km/h, multi-path fading channel requirements with high Doppler value

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions  (Annex G) | Fraction of maximum throughput | FRC  (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLC300-1200 | 70 % | G-FR1-A3-34A | pos2 | [-2.0] |

**<<End of first change>>**

**<<Start of second change>>**

## G.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., TDLA<DS>-<Doppler>, TDLB<DS>-<Doppler> or TDLC<DS>-<Doppler> where '<DS>' indicates the desired delay spread and '<Doppler>' indicates the maximum Doppler frequency (Hz).

Table G.2.2-1 and G.2.2-2 show the propagation conditions that are used for the performance measurements in multi-path fading environment for low, medium and high Doppler frequencies for FR1 and FR2, respectively.

Table G.2.2-1: Channel model parameters for FR1

|  |  |  |
| --- | --- | --- |
| Combination name | Tapped delay line model | Maximum Doppler frequency |
| TDLA30-5 | TDLA30 | 5 Hz |
| TDLA30-10 | TDLA30 | 10 Hz |
| TDLB100-400 | TDLB100 | 400 Hz |
| TDLC300-100 | TDLC300 | 100 Hz |
| TDLC300-100 | TDLC300 | 600 Hz |
| TDLC300-100 | TDLC300 | 1200 Hz |

Table G.2.2-2: Channel model parameters for FR2

|  |  |  |
| --- | --- | --- |
| Combination name | Tapped delay line model | Maximum Doppler frequency |
| TDLA30-75 | TDLA30 | 75 Hz |
| TDLA30-300 | TDLA30 | 300 Hz |

**<<End of second change>>**