**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **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 |  | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | Big CR on FR2 HST BS demodulation requirement for TS 38.104 |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** | F |  | ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Introduce BS demodulation requirement for Rel-17 FR2 HST. This big CR merges endorsed draf CR to TS38.104 in RAN4#104-e. The reason for change in endorsed draft CR is copied below:* R4-2214406:

Update FR2 HST PUSCH requirement applicabiltity rule based on last agreement. There is non more updated for simulation results based on the simulation results summary in the last meeting, the SNR with [] can be removed.* R4-2214738

Performance requirements for UL TA should be introduced for FR2 HST based on agreements.* R4-2214854

Add note that HST FR2 requirements are only applicable for FR2-1.Remove square brackets for NR HST FR2 PRACH minimum requirements for high speed train.* R4-2214825

PUSCH FRCs for HST FR2 were not completely defined in the previous version of the specification.FRCs for HST FR2 UL timing adjustment requirements are not defined. |
|  |  |
| ***Summary of change:*** | The summary of change in endorsed draft CR is copied as below:* R4-2214406:

Remove [] for SNR requirement* R4-2214738:

Change Table [A.4-2x] to Tables A.10-4, A.10-5, and A.10-6.Change TSRS =[10] to TSRS =80 in Table 11.2.2.8.1-1.Add FRC in Table 11.2.2.8.2-1.Remove [] for SNR in Table 11.2.2.8.2-1.Add limitation for requirement with for FR2-1 below 30GHz* R4-2214854

Add note that HST FR2 requirements are only applicable for FR2-1For HST FR2 PRACH minimum requirements for high speed train, update clause 11.4.2.2.3.* R4-2214825

Corrections and completions of PUSCH FRCs.Addition of new FRCs for UL timing adjustment requirements. |
|  |  |
| ***Consequences if not approved:*** | The consequences if not approved for endorsed draft CR are coppied as below.* R4-2214406:

HST FR2 PUSCH demodualtion performance requirements are not complete and can be not used* R4-2214738:

Performance requirements for UL TA for FR2 HST would be missing* R4-2214854

There will be inconsisint between RAN4 agreements and the specification* R4-2214825

HST FR2 BS demodulation performance requirements are not complete and cannot be used. |
|  |  |
| ***Clauses affected:*** | 4.6, 11.2.2.8.1, 11.2.2.8.2, 11.4.2.2.1, 11.4.2.2.3, A.10 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.141-2 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<Start Of Change R4-2214406>

#### 11.2.2.7 Requirements for PUSCH for high speed train

##### 11.2.2.7.1 General

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions. The performance requirements for high speed train are optional and only applicable for FR2-1 below 30GHz.

The performance requirements for PUSCH high speed train apply to Wide Area Base Stations and Medium Range Base Stations (subject to declaration).

Table 11.2.2.7.1-1: Test parameters for testing high speed train

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Default TDD UL-DL pattern (Note 1) | 3D1S1U, S=10D:2G:2U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS symbols | Pos0 or Pos1 or Pos2 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | 0 |
|  | DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain | PUSCH mapping type | B |
| resource | Start symbol index | 0  |
|  | Allocation length | 10 |
| Frequency domain | RB assignment | Full applicable test bandwidth |
| resource | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |
| PT-RS | Frequency density (*KPT-RS*) | 2 |
| configuration | Time density (*LPT-RS*) | 1 |
| NOTE 1: The same requirements are applicable to TDD with different UL-DL patterns |

##### 11.2.2.7.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 11.2.2.7.2-1 to 11.2.2.7.2-4 at the given SNR for 1Tx. FRCs are defined in an annex A. Unless stated otherwise, the MIMO correlation matrices for the gNB are defined in annex G for low correlation.

Table 11.2.2.7.2-1: Minimum requirements for PUSCH, Type B, 50 MHz channel bandwidth, 120 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | Scenario 4-BI-NR350, FR2 | 70% | G-FR2-A10-1 | pos0 | 12.9 |
| 1 | 2 | Normal | Scenario 4-BI-NR350, FR2 | 70% | G-FR2-A10-3, G-FR2-A10-5 | pos1, pos2 | 12.5 |

Table 11.2.2.7.2-2: Minimum requirements for PUSCH, Type B, 200 MHz channel bandwidth, 120 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 2 | Normal | Scenario 4-BI-NR350, FR2 | 70% | G-FR2-A10-2 | pos0 | 12.8 |
| 1 | 2 | Normal | Scenario 4-BI-NR350, FR2 | 70% | G-FR2-A10-4, G-FR2-A10-6  | pos1, pos2 | 12.3 |

<End Of Change R4-2214406>

<Start Of Change R4-2214738>

#### 11.2.2.8 Requirements for UL timing adjustment

##### 11.2.2.8.1 General

The performance requirement of UL timing adjustment is determined by a minimum required throughput for the moving UE at given SNR. The performance requirements assume HARQ retransmissions. The performance requirements for UL timing adjustment scenario Y defined in Annex G.4 are optional and only applicable for FR2-1 below 30GHz.

In the tests for UL timing adjustment, two signals are configured, one being transmitted by a moving UE and the other being transmitted by a stationary UE. The transmission of SRS from UE is optional. FRC parameters in Tables A.10-4, A.10-5, and A.10-6 are applied for both UEs. The received power for both UEs is the same. The resource blocks allocated for both UEs are consecutive. In scenario Y, Doppler shift is not taken into account.

Table 11.2.2.8.1-1 Test parameters for testing UL timing adjustment

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Uplink-downlink allocation for TDD | 120 kHz SCS:3D1S1U, S=10D:2G:2U |
| Channel bandwidth | 120 kHz SCS: 50MHz, 200 MHz |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | DM-RS position (*l0*) | 2 |
|  | Additional DM-RS position | pos0, pos1, pos2 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port | {0} |
| Time domain resource assignment | DM-RS sequence generation | NID0=0, nSCID =0 for moving UENID0=1, nSCID =1 for stationary UE |
|  | PUSCH mapping type | B |
|  | Allocation length | 10  |
| Frequency domain resource assignment | RB assignment | 50 MHz CBW/120kHz SCS: 16 RB for each UE200MHz CBW/120kHz SCS: 66 RB for each UE |
|  | Starting PRB index | Moving UE: 0 Stationary UE: 16 for 50MHz CBW, 66 for 200MHz CBW for SCS 120kHz |
|  | Frequency hopping | Disabled |
| SRS resource allocation | Slots in which sounding RS is transmitted (Note 1) | For TDD: - last symbol in slot #3 in radio frames for 120KHz |
|  | SRS resource allocation | 120 kHz SCS:  - CSRS = 9, BSRS =0, for 32 RB - CSRS = 33, BSRS =0, for 132 RB |
| NOTE 1. The transmission of SRS is optional. And the transmission comb and SRS periodic are configured as KTC = 2, and TSRS = 80 respectively. |

##### 11.2.2.8.2 Minimum requirements for high speed train

The throughput shall be ≥ 70% of the maximum throughput of the reference measurement channel as specified in Annex A for the moving UE at the SNR given in table 11.2.2.8.2-1 for mapping type B.

Table 11.2.2.8.2-1 Minimum requirements for UL timing adjustment with mapping type B for high speed train

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Channel Bandwidth [MHz] | SCS [kHz] | Moving propagation conditions and correlation matrix (Annex G) | FRC(Annex A) | SNR[dB] |
| 1 | 2 | Normal | 50 | 120 | Scenario Y | G-FR2-A10-7 | 9.1 |
|  |  |  |  |  | Scenario Y | G-FR2-A10-9, G-FR2-A10-11 | 8.8 |
|  |  |  | 200 | 120 | Scenario Y | G-FR2-A10-8 | 9.0 |
|  |  |  |  |  | Scenario Y | G-FR2-A10-10, G-FR2-A10-12 | 8.9 |

<End Of Change R4-2214738>

<Start Of Change R4-2214854>

11.4.2.2.1 General

The probability of detection is the conditional probability of correct detection of the preamble when the signal is present. There are several error cases – detecting different preamble than the one that was sent, not detecting a preamble at all or correct preamble detection but with the wrong timing estimation. For AWGN and TDLA30-300, a timing estimation error occurs if the estimation error of the timing of the strongest path is larger than the time error tolerance given in Table 11.4.2.2-1.

The performance requirements for high speed train (table 11.4.2.2.3-1) are optional and only applicable for FR2-1 below 30GHz.

**Table 11.4.2.2-1: Time error tolerance for AWGN and TDLA30-300**

|  |  |  |
| --- | --- | --- |
| **PRACH**  | **PRACH SCS**  | **Time error tolerance** |
| **preamble** | **(kHz)** | **AWGN** | **TDLA30-300** |
| A1, A2, A3, B4, | 60 | 0.13 us | 0.28 us |
| C0, C2 | 120 | 0.07 us | 0.22 us |

The test preambles for normal mode are listed in table A.6-2 and the test parameter *msg1-FrequencyStart* is set to 0. The test preambles for high speed train short formats are listed in table A.6-7 and the test parameter *msg1-FrequencyStart* for high speed train is set to 0.

11.4.2.2.3 Minimum requirements for high speed train

The probability of detection shall be equal to or exceed 99% for the SNR levels listed in Table 11.4.2.2.3-1.

**Table 11.4.2.2.3-1: PRACH missed detection requirements for high speed train, 120 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of****TX antennas** | **Number of****RX antennas** | **Propagation****conditions (Annex G)** | **Frequency****offset** | **SNR (dB)** |
| **Burst format C2** |
| 1 | 2 | AWGN | 19444 Hz | -10.4 |

<End Of Change R4-2214854>

<Start Of Change R4-2214825>

# A.10 Fixed Reference Channels for performance requirements (64QAM, R=517/1024)

The parameters for the reference measurement channels are specified in table A.10-1, A.10-2 and A.10-3 for FR2 PUSCH performance requirements:

- FRC parameters are specified in table A.10-1 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos0* and 1 transmission layer.

- FRC parameters are specified in table A.10-2 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

- FRC parameters are specified in table A.10-3 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos2* and 1 transmission layer.

The parameters for the reference measurement channels are specified in table A.10-4, table A.10-5 and table A.10-6 for FR2 PUSCH UL timing adjustment perfromance requirements:

* FRC parameters are specified in table A.10-4 for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, *Additional* *DM-RS position = pos0* and 1 transmission layer.
* FRC parameters are specified in table A.10-5 for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, *DM-RS position = pos1* and 1 transmission layer.
* FRC parameters are specified in table A.10-6 for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, *Additional* *Additional* *DM-RS position = pos2* and 1 transmission layer.

Table A.10-1: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos0 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-1 | G-FR2-A10-2 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 32 | 132 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 9 | 9 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 10504 | 43032 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 2 | 6 |
| Code block size including CRC (bits) (Note 2) | 5288 | 7200 |
| Total number of bits per slot without PT-RS | 20736 | 85536 |
| Total number of bits per slot with PT-RS (Note 3) | 19872 | 81972 |
| Total resource elements per slot without PT-RS | 3456 | 14256 |
| Total resource elements per slot with PT-RS (Note 3) | 3312 | 13662 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos0* with *l0*= 0 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.10-2: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-3 | G-FR2-A10-4 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 32 | 132 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 8 | 8 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 9224 | 37896 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 2 | 5 |
| Code block size including CRC (bits) (Note 2) | 4648 | 7608 |
| Total number of bits per slot without PT-RS | 18432 | 76032 |
| Total number of bits per slot with PT-RS (Note 3) | 17664 | 72864 |
| Total resource elements per slot without PT-RS | 3072 | 12672 |
| Total resource elements per slot with PT-RS (Note 3) | 2944 | 12144 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1* with *l0*= 0 and *l* =8 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.10-3: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos2 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-5 | G-FR2-A10-6 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 32 | 132 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 7 | 7 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 8064 | 33816 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | - | 24 |
| Number of code blocks - C | 1 | 5 |
| Code block size including CRC (bits) (Note 2) | 8088 | 6792 |
| Total number of bits per slot without PT-RS | 16128 | 66528 |
| Total number of bits per slot with PT-RS (Note 3) | 15456 | 63756 |
| Total resource elements per slot without PT-RS | 2688 | 11088 |
| Total resource elements per slot with PT-RS (Note 3) | 2576 | 10626 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos2* with *l0*= 0 and *l* =4,8 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.10-4: FRC parameters for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, Additional DM-RS position = pos0 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-7 | G-FR2-A10-8 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 16 | 66 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 9 | 9 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 5248 | 21504 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | - | 24 |
| Number of code blocks - C | 1 | 3 |
| Code block size including CRC (bits) (Note 2) | 5272 | 7200 |
| Total number of bits per slot without PT-RS | 10368 | 42768 |
| Total number of bits per slot with PT-RS (Note 3) | 9936 | 40986 |
| Total resource elements per slot without PT-RS | 1728 | 7128 |
| Total resource elements per slot with PT-RS (Note 3) | 1656 | 6831 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos0* with *l0*= 0 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.10-5: FRC parameters for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-9 | G-FR2-A10-10 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 16 | 66 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 8 | 8 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 4608 | 18960 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | - | 24 |
| Number of code blocks - C | 1 | 3 |
| Code block size including CRC (bits) (Note 2) | 4632 | 6352 |
| Total number of bits per slot without PT-RS | 9216 | 38016 |
| Total number of bits per slot with PT-RS (Note 3) | 8832 | 36432 |
| Total resource elements per slot without PT-RS | 1536 | 6336 |
| Total resource elements per slot with PT-RS (Note 3) | 1472 | 6072 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1* with *l0*= 0 and *l* =8 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.10-6: FRC parameters for FR2 UL timing adjustment requirements, PUSCH with transform precoding disabled, Additional DM-RS position = pos2 and 1 transmission layer (64QAM, R=517/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR2-A10-11 | G-FR2-A10-12 |
| Subcarrier spacing [kHz] | 120 | 120 |
| Allocated resource blocks | 16 | 66 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 7 | 7 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 517/1024 | 517/1024 |
| Payload size (bits) | 4032 | 16896 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | - | 24 |
| Number of code blocks - C | 1 | 3 |
| Code block size including CRC (bits) (Note 2) | 4056 | 5664 |
| Total number of bits per slot without PT-RS | 8064 | 33264 |
| Total number of bits per slot with PT-RS (Note 3) | 7728 | 31878 |
| Total resource elements per slot without PT-RS | 1344 | 5544 |
| Total resource elements per slot with PT-RS (Note 3) | 1288 | 5313 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos2* with *l0*= 0 and *l* =4,8 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

<End Of Change R4-2214825>