**3GPP TSG-RAN WG4 Meeting #109 R4-2320219**

**Chicago, 13th - 17th Nov, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.104** | **CR** | **Draft** | **rev** | **-** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *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:*** | [NR\_ATG-Perf] Draft CR on ATG PUSCH demodulation performance requirements and FRC definition (TS38.104, Rel-18) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ATG-Perf | | | | |  | ***Date:*** | | | 2023-11-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduce ATG PUSCH demodulation performance requirements and FRC definition. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | For introducing ATG PUSCH demodulation performance requirements and FRC definition, update clause 3.3, add new clause 8.2.x, 11.2.1.x, A.y, A.z. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be inconsist between specification and RAN4 agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.3, 8.2.x (New clause), 11.2.1.x (New clause), A.y (New clause), A.z (New clause) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.141-1, 38.141-2 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | New clause: 8.2.x, 11.2.1.x, A.y, A.z | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*<START OF THE CHANGE 1>*

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AA Antenna Array

AAS Active Antenna System

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

AoA Angle of Arrival

ATG Air-To-Ground

AWGN Additive White Gaussian Noise

BS Base Station

BW Bandwidth

CA Carrier Aggregation

CACLR Cumulative ACLR

CPE Common Phase Error

CP-OFDM Cyclic Prefix-OFDM

CW Continuous Wave

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DM-RS Demodulation Reference Signal

EIS Equivalent Isotropic Sensitivity

EIRP Effective Isotropic Radiated Power

E-UTRA Evolved UTRA

EVM Error Vector Magnitude

FBW Fractional Bandwidth

FR Frequency Range

FRC Fixed Reference Channel

GSCN Global Synchronization Channel Number

GSM Global System for Mobile communications

HAPS High Altitude Platform Station

ITU‑R Radiocommunication Sector of the International Telecommunication Union

ICS In-Channel Selectivity

LA Local Area

LNA Low Noise Amplifier

MCS Modulation and Coding Scheme

MR Medium Range

NB-IoT Narrowband – Internet of Things

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

OBUE Operating Band Unwanted Emissions

OCC Orthogonal Covering Code

OOB Out-of-band

OSDD OTA Sensitivity Directions Declaration

OTA Over-The-Air

PRB Physical Resource Block

PT-RS Phase Tracking Reference Signal

QAM Quadrature Amplitude Modulation

RB Resource Block

RDN Radio Distribution Network

RE Resource Element

REFSENS Reference Sensitivity

RF Radio Frequency

RIB Radiated Interface Boundary

RMS Root Mean Square (value)

RoAoA Range of Angles of Arrival

QAM Quadrature Amplitude Modulation

RB Resource Block

RX Receiver

SCS Sub-Carrier Spacing

SDL Supplementary Downlink

SS Synchronization Symbol

SSB Synchronization Signal Block

SUL Supplementary Uplink

TAB Transceiver Array Boundary

TAE Time Alignment Error

TDL Tapped Delay Line

TX Transmitter

TRP Total Radiated Power

UCI Uplink Control Information

UEM Unwanted Emissions Mask

UTRA Universal Terrestrial Radio Access

WA Wide Area

ZF Zero Forcing

*<END OF THE CHANGE 1>*

*<START OF THE CHANGE 2>*

8.2.x Requirements for PUSCH for ATG

8.2.x.1 General

The performance requirement of PUSCH for ATG 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.

**Table: 8.2.x.1-1 Test parameters for testing PUSCH** **for ATG**

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern (Note 1) | | 15kHz SCS: N/A  30 kHz SCS: 7D1S2U, S=6D:4G:4U |
| 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 position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port | {0} |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain resource assignment | PUSCH mapping type | A |
| 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 TDD with different UL-DL pattern, e.g., 30D4S6U, S=40G for 30kHz SCS. | | |

8.2.x.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.x.2-1 for FDD duplex mode and 8.2.x.2-2 for TDD duplex mode at the given SNR for 1Tx transmission. FRCs are defined in annex A.

**Table 8.2.x.2-1: Minimum requirements for PUSCH for ATG with 70% of maximum throughput, Type A, 5 MHz channel bandwidth, 15 kHz SCS, FDD duplex mode**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of TX antennas** | **Number of RX antennas** | **Cyclic prefix** | **Propagation conditions and correlation matrix (Annex G)** | **Frequency offset** | **Fraction of maximum throughput** | **FRC (Annex A)** | **Additional DM-RS position** | **SNR**  **(dB)** |
| 1 | 2 | Normal | AWGN | 200 | 70 % | G-FR1-A11-1 | pos1 | [TBD] |
| Normal | AWGN | 200 | 70 % | G-FR1-A12-1 | pos1 | [TBD] |

**Table 8.2.1.2-2: Minimum requirements for PUSCH for ATG with 70% of maximum throughput, Type A, 10 MHz channel bandwidth, 30 kHz SCS, TDD duplex mode**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of TX antennas** | **Number of RX antennas** | **Cyclic prefix** | **Propagation conditions and correlation matrix (Annex G)** | **Frequency offset** | **Fraction of maximum throughput** | **FRC (Annex A)** | **Additional DM-RS position** | **SNR**  **(dB)** |
| 1 | 2 | Normal | AWGN | 500 | 70 % | G-FR1-A11-2 | pos1 | [TBD] |
| Normal | AWGN | 500 | 70 % | G-FR1-A12-2 | pos1 | [TBD] |

*<END OF THE CHANGE 2>*

*<START OF THE CHANGE 3>*

11.2.1.x Requirements for PUSCH for ATG

Apply the requirements for 2Rx defined in clause 8.2.x for 2Rx.

*<END OF THE CHANGE 3>*

*<START OF THE CHANGE 4>*

A.y Fixed Reference Channels for performance requirements (64QAM, R=948/1024)

The parameters for the reference measurement channels are specified in table A.y-1 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.y-1 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

**Table A.y-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (64QAM, R=948/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR1-Ay-1** | **G-FR1-Ay-2** |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 25 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | 64QAM | 64QAM |
| Code rate (Note 2) | 948/1024 | 948/1024 |
| Payload size (bits) | 19968 | 18960 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 3 | 3 |
| Code block size including CRC (bits) (Note 2) | 6688 | 6352 |
| Total number of bits per slot | 21600 | 20736 |
| Total symbols per slot | 3600 | 3456 |
| 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*, *l0*= 2 and *l* =11 for PUSCH mapping type A, 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]. | | |

*<END OF THE CHANGE 4>*

*<START OF THE CHANGE 5>*

A.z Fixed Reference Channels for performance requirements (256QAM, R=754/1024)

The parameters for the reference measurement channels are specified in table A.z-1 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.z-1 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

**Table A.z-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (256QAM, R=754/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR1-Az-1** | **G-FR1-Az-2** |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 25 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | 256QAM | 256QAM |
| Code rate (Note 2) | 754/1024 | 754/1024 |
| Payload size (bits) | 21000 | 20496 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 3 | 3 |
| Code block size including CRC (bits) (Note 2) | 7032 | 6864 |
| Total number of bits per slot | 28800 | 27648 |
| Total symbols per slot | 3600 | 3456 |
| 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*, *l0*= 2 and *l* =11 for PUSCH mapping type A, 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]. | | |

*<END OF THE CHANGE 5>*