**3GPP TSG RAN WG1 Meeting #100bis-e R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Source: ZTE**

**Title: Maintenance of low PAPR RS**

**Agenda item: 7.2.6.5**

**Document for:** **Discussion/Decision**

# Introduction

In Rel-16, low PAPR RS is introduced including DMRS for CP-OFDM and DFT-S-OFDM. In this meeting, we provide our views on some issues of the latest endorsed specifications.

This contribution is the revised version of R1-2001599.

# Discussion on maintenance

In Rel-16, DCI format 0\_2 is introduced for URLLC. It should be clarified if the agreed π/2-BPSK DMRS can be used for PUSCH scheduled by DCI 0\_2 or not. In our view, if the higher-layer parameter *DMRSuplinkTransformPrecoding-r16* is configured and π/2-BPSK modulation is used for PUSCH, it is natural to support the π/2-BPSK DMRS to achieve low PAPR benefit*.*

So we suggest that the agreed π/2-BPSK DMRS can be used for PUSCH scheduled by DCI 0\_2. The corresponding text proposals for both 38.211 and 38.212 are provided below. The analysis for each TP is provided as well.

## Text proposal 1 for TS 38.211 [1]:

**Reason for change:** DCI format 0\_2 is introduced for URLLC in Rel-16. It should be clarified whether the low-PAPR DMRS agreed in Rel-16 can be used for a PUSCH with π/2-BPSK modulation scheduled by DCI format 0\_2.

**Summary of change:** Add description on sequence generation for a transmission scheduled by DCI format 0\_2 if Antenna ports field in the DCI format 0\_2 is not 0 bit.

**Consequences if not approved:** The low-PAPR DMRS agreed in Rel-16 cannot be used for a PUSCH with π/2-BPSK modulation scheduled by DCI format 0\_2.

**Clauses affected:** Section 6.4.1.1.1.2

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| 6.4.1.1.1.2 Sequence generation when transform precoding is enabledIf transform precoding for PUSCH is enabled, the reference-signal sequence  shall be generated according towhere $r\_{u,v}^{\left(α,δ\right)}(n)$ with $δ=1$ and $α=0$ depends on the configuration:- if the higher-layer parameter *dmrsUplinkTransformPrecoding-r16* is configured, π/2-BPSK modulation is used for PUSCH, and the PUSCH transmission is not a msg3 transmission, and the transmission is not scheduled using DCI format 0\_0 in a common search space, $r\_{u,v}^{\left(α,δ\right)}(n)$ is given by clause 5.2.3 with $c\_{init}$ given by$$c\_{init}=\left(2^{17}\left(N\_{symb}^{slot}n\_{s,f}^{μ}+l+1\right)\left(2N\_{ID}^{n\_{SCID}}+1\right)+2N\_{ID}^{n\_{SCID}}+n\_{SCID}\right)mod 2^{31}$$ where $n\_{SCID}=0$ unless given by the DCI according to clause 7.3.1.1.2 in [4, TS38.212] for a transmission scheduled by DCI format 0\_1 or given by the DCI according to clause 7.3.1.1.3 in [4, TS38.212] for a transmission scheduled by DCI format 0\_2 if Antenna ports field in the DCI format 0\_2 is not 0 bit or given by the higher-layer parameter *antennaPort* for a PUSCH transmission scheduled by a type-1 configured grant; and- $N\_{ID}^{0},N\_{ID}^{1}\in \left\{0,1,…,65535\right\}$ are given by the higher-layer parameters *pi2BPSKscramblingID0* and *pi2BPSKscramblingID1*, respectively, in the *DMRS-UplinkConfig* IE if provided and the PUSCH is scheduled by DCI format 0\_1 or by DCI format 0\_2 if Antenna ports field in the DCI format 0\_2 is not 0 bit or by a PUSCH transmission with a configured grant;- $N\_{ID}^{0}\in \left\{0,1,…,65535\right\}$ is given by the higher-layer parameter *pi2BPSKscramblingID0* in the *DMRS-UplinkConfig* IE if provided and the PUSCH is scheduled by DCI format 0\_0 with the CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI or by DCI format 0\_2 if Antenna ports field in the DCI format 0\_2 is 0 bit;- $N\_{ID}^{n\_{SCID}}=N\_{ID}^{cell}$ otherwise; - otherwise, $r\_{u,v}^{\left(α,δ\right)}(n)$ is given by clause 5.2.2.<Unchanged parts are omitted> |

## Text proposal 2 for TS 38.212 [2]:

**Reason for change:** DCI format 0\_2 is introduced for URLLC in Rel-16. It should be clarified whether the low-PAPR DMRS agreed in Rel-16 can be used for a PUSCH with π/2-BPSK modulation scheduled by DCI format 0\_2..

**Summary of change:** Add low-PAPR DMRS related descriptions for Antenna ports field of DCI format 0\_2.

**Consequences if not approved:** The low-PAPR DMRS agreed in Rel-16 cannot be used for a PUSCH with π/2-BPSK modulation scheduled by DCI format 0\_2

**Clauses affected:** Section 7.3.1.1.3

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| **7.3.1.1.3 Format 0\_2**<Unchanged parts are omitted>- Antenna ports – number of bits determined by the following:- 0 bit if higher layer parameter *AntennaPorts-FieldPresence-ForDCIFormat0\_2* is notconfigured;- 2, 3, 4, or 5 bits otherwise,- 2 bits as defined by Tables 7.3.1.1.2-6, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=1, except that *DMRS-uplinkTransformPrecoding-r16* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;- 2 bits as defined by 7.3.1.1.2-6A, if transform precoder is enabled, and *DMRS-uplinkTransformPrecoding-r16* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=1, where nSCID is the scrambling identity for antenna ports defined in Clause 6.4.1.1.1.2, in [4, TS38.211];-     4 bits as defined by Tables 7.3.1.1.2-7, if transform precoder is enabled, *dmrs-Type*=1, and *maxLength*=2, except that *DMRS-uplinkTransformPrecoding-r16* and *tp-pi2BPSK* are both configured and π/2 BPSK modulation is used;-  4 bits as defined by Tables 7.3.1.1.2-7A, if transform precoder is enabled, and *DMRS-uplinkTransformPrecoding-r16* and *tp-pi2BPSK* are both configured, π/2 BPSK modulation is used, *dmrs-Type*=1, and *maxLength*=2, where nSCID is the scrambling identity for antenna ports defined in Clause 6.4.1.1.1.2, in [4, TS38.211];- 3 bits as defined by Tables 7.3.1.1.2-8/9/10/11, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;- 4 bits as defined by Tables 7.3.1.1.2-12/13/14/15, if transform precoder is disabled, *dmrs-Type*=1, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;- 4 bits as defined by Tables 7.3.1.1.2-16/17/18/19, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=1, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*;- 5 bits as defined by Tables 7.3.1.1.2-20/21/22/23, if transform precoder is disabled, *dmrs-Type*=2, and *maxLength*=2, and the value of rank is determined according to the SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook* and according to the Precoding information and number of layers field if the higher layer parameter *txConfig = codebook*.<Unchanged parts are omitted> |

# Conclusion

In this contribution, we provide our TPs on low-PAPR PUSCH DMRS. The details of the TPs can be found in section 2.

# Reference

1. 38.211 g10, NR Physical channels and modulations (Release 16)
2. 38.212 g10, NR Multiplexing and channel coding (Release 16)