**3GPP TSG RAN WG1 Meeting #108-e R1-22xxxxx**

**e-Meeting, February 21 – March 3, 2022**

**Agenda Item: 8.9.1**

**Source: Moderator (Huawei)**

**Title: Text proposals for NB-IoT 16QAM**

**Document for: Discussion and Decision**

# Introduction

Based on the following email discussion, the text proposals in section 2 are proposed to be endorsed.

[108-e-LTE-Rel17-NB-IoT-eMTC-01] Email discussion on support of 16-QAM for unicast in UL and DL for NB-IoT – Yubo (Huawei)

* 1st check point: November 15
* Final check point: November 19

# Text proposals

## Text proposals to TS 36.212

It is proposed to clarify the difference of modulation between NB-IoT and section 5.1.4.1.2 in the TB processing, with the following text proposal:

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| ===========================TP starts==============================   1. 6.3.2 Uplink shared channel   Figure 6.3.2-1 shows the processing structure for the UL-SCH transport channel. Data arrives to the coding unit in the form of a maximum of one transport block over a number of resource units per UL cell. The number of resource units is scheduled according to [3]. The following coding steps can be identified:  - CRC attachment  - Channel coding  - Rate matching    **Figure 6.3.2-1: Transport block processing for UL-SCH**  The CRC attachment, channel coding, and rate matching are performed according to clauses 5.2.2.1, 5.2.2.3, and 5.2.2.4, respectively, with the following differences:  - In clause 5.1.4.1.2 in the calculation of  , *Qm* is 2 for π/4-QPSK, and *rvidx* = 0 or 2.  ===========================TP ends============================== |

## Text proposals to TS 36.213

### EPRE for 16-QAM

It is proposed to replace the description of constant power between symbols by equations, with the following text proposal

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| ===========================TP starts==============================  16.2.2 Downlink power allocation  *<unchanged parts omitted>*  If a UE is configured with higher layer parameters *npdsch-16QAM-Config* and *nrs-PowerRatio*, - the ratio of NPDSCH EPRE to NRS EPRE among NPDSCH REs in symbols with NRS is given by for a cell with one NRS antenna port and for a cell with two NRS antenna ports, where is given by the parameter *nrs-PowerRatio*. - if higher layer parameter *operationModeInfo* indicates '10' or '11',  - the ratio of NPDSCH EPRE to NRS EPRE among NPDSCH REs (not applicable to NPDSCH REs with zero EPRE) is given by the parameter *nrs-PowerRatio* in symbols without NRS  - otherwise,  - the ratio of NPDSCH EPRE to NRS EPRE among NPDSCH REs (not applicable to NPDSCH REs with zero EPRE) is given by the parameter *nrs-PowerRatio* in symbols without NRS and CRS, and  - the ratio of NPDSCH EPRE to NRS EPRE among NPDSCH REs (not applicable to NPDSCH REs with zero EPRE) is given by the parameter *nrs-PowerRatioWithCRS* in symbols with CRS.  ===========================TP ends============================== |

### Configuration for PUR

It is proposed to capture the use of 16QAM for NPUSCH with the following text proposal:

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| ===========================TP starts==============================  ***16.4.1.5 Modulation order and transport block size determination***  To determine the modulation order in the NPDSCH, the UE shall  - if the UE is configured with higher layer parameter *npdsch-16QAM-Config* and the DCI is mapped onto the UE specific search space given by C-RNTI, or the UE is configured with higher layer parameter *pur-DL-16QAM-Config* and the DCI is mapped onto the UE specific search space given by PUR-RNTI,  - If the 4-bit "modulation and coding scheme" field () in the DCI is set to ‘1111’,  - use modulation order, **=** 4  - otherwise  - use modulation order, **=** 2.  - otherwise  - use modulation order, **=** 2.  ===========================TP ends============================== |

### The indices of MCS for PUR NPUSCH

It is proposed to clarify how the indices of TBS for PUR NPUSCH is provided with the following text proposal:

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| ===========================TP starts==============================  16.5.1.2 Modulation order, redundancy version and transport block size determination  <unchanged part is omitted>  The UE shall use (,) and Table 16.5.1.2-2 to determine the TBS to use for the NPUSCH. is given in Table 16.5.1.2-1 if , or if NPUSCH with 16QAM except for NPUSCH transmission using preconfigured uplink resource in which case is given by higher layers in *PUR-Config-NB*,  otherwise. is the value of the "modulation and coding scheme for 16QAM" in the DCI.  ===========================TP ends============================== |

### Uplink power control for NPUSCH when 16QAM is configured

It is proposed to clarify that NPUSCH with QPSK or 16QAM will use the introduced term when 16QAM is configured, with the following text proposal:

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| ===========================TP starts==============================  16.2.1.1.1 UE behaviour  *<unchanged parts omitted>* - If a NB-IoT UE is configured with npusch-16QAM-Config or pur-UL-16QAM-Config, then for NPUSCH (re)transmissions with QPSK and 16QAM, - for and for where  is given by the parameter *deltaMCS-Enabled* provided by higher layers for serving cell , and  - where is the code block size and is the number of resource elements determined as where , , are defined in [3], and is defined in section 16.5.1.1 - otherwise . ===========================TP ends============================== |