**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 $\frac{1}{5}×(6ρ-1)$ for a cell with one NRS antenna port and $\frac{1}{4}×(6ρ-1)$ for a cell with two NRS antenna ports, where $ρ$ 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 $I\_{TBS}=I\_{MCS}^{'}+14$ if NPUSCH with 16QAM except for NPUSCH transmission using preconfigured uplink resource in which case $I\_{TBS} $is given by higher layers in *PUR-Config-NB*,  otherwise. $I\_{MCS}^{'}$ 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 $Δ\_{TF,c}\left(i\right)$ 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,- $Δ\_{TF,c}\left(i\right)=10log\_{10}\left(\left(2^{BPRE⋅K\_{s}}-1\right)\right)$ for and $∆\_{TF,c}(i)=0$ for where  is given by the parameter *deltaMCS-Enabled* provided by higher layers for serving cell , and- $BPRE=K/N\_{RE}$ where $K$ is the code block size and $N\_{RE}$ is the number of resource elements determined as $N\_{RE}=(N\_{symb}^{UL}-1)N\_{slots}^{UL}N\_{sc}^{RU}N\_{RU}$ where $N\_{symb}^{UL}$, $N\_{slots}^{UL}$, $N\_{sc}^{RU}$ are defined in [3], and $N\_{RU}$ is defined in section 16.5.1.1- otherwise $∆\_{TF,c}(i)=0$.===========================TP ends============================== |