**3GPP TSG RAN WG1 #101-e R1-200----**

**e-Meeting, February 24th – March 6th, 2020**

**Agenda item:** 6.2.1.2 Support for transmission in preconfigured UL resources

**Source:** Moderator **(**Sierra Wireless)

**Title:** LTE-M Preconfigured UL resources feature lead summary #1 RAN1 #101-e

**Document for**: Discussion

# Introduction

This contribution summarizes LTE-M PUR related maintenance issues for RAN1 #101-e.

According to the guidance of the chairman below, the intention of this contribution is to provide a list of issues/proposals and identify the set of email threads.

* May 18th – 22nd: preparation phase
	+ May 18th – 19th: FLs to prepare summary
	+ May 20th – 22nd: FLs to lead the discussion identifying the set of email threads

# Maintenance Issues

## Sub-PUR allocation for retransmissions

**Issue**: Sub-PRB resource allocation is supported for PUR retransmissions but in TS 36.212 the field “Number of resource units – 2 bits” in DCI format 6-0A and “Flag for sub-PRB resource allocation – 1 bit” in DCI format 6-0B , which are used to indicate whether sub-PRB resource allocation is configured, are not present when the DCI format 6-0A/B CRC is scrambled by PUR C-RNTI.

ZTE[3] provided the following TP for TS 36.212:

**<Unchanged parts are omitted>**

**5.3.3.1.10 Format 6-0A**

DCI format 6-0A is used for the scheduling of PUSCH in one UL cell, for the indication of ACK feedback, and operation on preconfigured UL resources.

The following information is transmitted by means of the DCI format 6-0A:

- Flag format 6-0A/format 6-1A differentiation – 1 bit, where value 0 indicates format 6-0A and value 1 indicates format 6-1A

- Frequency hopping flag – 1 bit, where value 0 indicates frequency hopping is not enabled and value 1 indicates frequency hopping is enabled as defined in clause 5.3.4 of [2]. The field is not present if *multi-TB-UL-config* is enabled and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3].

- Number of resource units – 2 bits, where value '00' indicates the format 6-0A DCI uses PRB resource allocation, otherwise the DCI format 6-0A uses sub-PRB resource allocation as defined in clause 8.1.6 of [3]. This field is present when *ce-PUSCH-SubPRB-Config* is configured by higher layers and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3] or when the DCI is mapped to UE-specific search space scrambled by PUR C-RNTI.

**<Unchanged parts are omitted>**

**5.3.3.1.11 Format 6-0B**

DCI format 6-0B is used for the scheduling of PUSCH in one UL cell, for the indication of ACK feedback, and operation on preconfigured UL resources.

The following information is transmitted by means of the DCI format 6-0B:

- Flag for format 6-0B/format 6-1B differentiation – 1 bit, where value 0 indicates format 6-0B and value 1 indicates format 6-1B

- Flag for sub-PRB resource allocation – 1 bit, where value 1 indicates the format 6-0B DCI uses sub-PRB resource allocation and value 0 indicates the format 6-0B DCI does not use sub-PRB resource allocation. This field is present when *ce-PUSCH-SubPRB-Config* is configured by higher layers and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3] or when  the DCI is mapped onto the UE-specific search space scrambled by PUR C-RNTI.

- Modulation and coding scheme – 4 bits as defined in clause 8.6 of [3]. The field is only present if format 6-0B CRC is scrambled by PUR C-RNTI and for not sub-PRB resource allocation.

**<Unchanged parts are omitted>**

## PUCCH power control

**Issue #1**: PUCCH power control clause 5.1.2.1 missed to include the PUR C-RNTI for DCI format 6-1A.

**Issue #2:** There are terms in the “UE Transmit power” equation defined in TS 36.213 which are unclear when the UE is configured with PUR. Whether PUCCH should use open loop or closed loop power control is an open issue.

Ericsson [4] provided the following TPs for TS 36.213 and TS 36.212 where PUCCH uses open-loop power control:

--------------------------------------------------- 36.213 ---------------------------------------------------------

--------------------------------------------------- Text start ---------------------------------------------------------

5.1.2.1 UE behaviour

If serving cell is the primary cell, for PUCCH format 1/1a/1b/2/2a/2b/3, the setting of the UE Transmit powerfor the physical uplink control channel (PUCCH) transmission in subframe/slot/subslot *i* for serving cell is defined by

-------------------------------------------------- Text omitted -----------------------------------------------------

- For a BL/CE UE configured with CEModeA, the UE attempts to decode a MPDCCH of DCI format 3/3A with the UE's TPC-PUCCH-RNTI and MPDCCH of DCI format 6-1A with the UE's C-RNTI or SPS C-RNTI or PUR C-RNTI on every BL/CE downlink subframe except when in DRX.

- If the UE decodes

- a PDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D/7-1A/1B/1C/1D/1E/1F/1G or

- an EPDCCH with DCI format 1A/1B/1D/1/2A/2/2B/2C/2D or

- an MPDCCH with DCI format 6-1A or

- a SPDCCH with DCI format 7-1A/1B/1C/1D/1E/1F/1G

for the primary cell and the corresponding detected RNTI equals the C-RNTI or SPS C-RNTI of the UE and the TPC field in the DCI format is not used to determine the PUCCH resource as in Subclause 10.1, the UE shall use the  provided in that PDCCH/EPDCCH/MPDCCH/SPDCCH.

 Else

- if the UE decodes a PDCCH/MPDCCH with DCI format 3/3A, the UE shall use the  provided in that PDCCH/MPDCCH

 else the UE shall set  = 0 dB.

-  where  is the current PUCCH power control adjustment state and where is the first value after reset.

------------------------------------------------- Text omitted -------------------------------------------------------

- If  value is preconfigured or changed by higher layers,

- 

Note: g(i) = 0 for i = 0,1,… up to the last subframe of the PUCCH transmission using preconfigured uplink resource.

----------------------------------------------- Text end ------------------------------------------------------------

--------------------------------------------------- 36.212 ---------------------------------------------------------

------------------------------------------------- Text omitted -------------------------------------------------------

- TPC command for PUCCH – 2 bits as defined in clause 5.1.2.1 of [3] . This field is not present when the format 6-1A CRC is scrambled with G-RNTI or PUR C-RNTI.

- If the format 6-1A CRC is scrambled by RA-RNTI:

- The most significant bit of the TPC command is reserved.

- The least significant bit of the TPC command indicates column of the TBS table defined of [3].

- If least significant bit is 0 then = 2 else = 3.

- Else

- The two bits including the most significant bit indicate the TPC command

----------------------------------------------- Text end ------------------------------------------------------------

## Power control accumulation mechanism

**Issue**: Power control accumulation mechanism was agreed to be supported for transmission in PUR. In TS36.213 the accumulation is normally enabled based on the parameter *Accumulation-enabled* or *accumulationEnabledsTTI* provided by higher layers or if the TPC command is included in a MPDCCH with DCI format 6-0A for serving cell  where the CRC is scrambled by the Temporary C-RNTI. However, there is no configuration specified for transmission in PUR.

ZTE[3] provide a TP for TS 36.213:

**5.1.1.1 UE behaviour**

**<Unchanged parts are omitted>**

-  and  if accumulation is enabled based on the parameter *Accumulation-enabled* or *accumulationEnabledsTTI or Accumulation-enabled-PUR* provided by higher layers or if the TPC command  is included in a PDCCH/EPDCCH with DCI format 0 or in a MPDCCH with DCI format 6-0A for serving cell  where the CRC is scrambled by the Temporary C-RNTI

## Timing advance adjustment via DCI

**Issue**: For PUR TA can be updated in two ways: TA command from MAC CE (legacy way), or TA adjustment from PUR ACK DCI (newly introduced in Rel-16 PUR). The description in TS 36.213 does not include update from DCI.

TP provided by Huawei/HiSilicon [1] is:

**-------------------------------------------Start of Text Proposal for 36.213------------------------------------------**

4.2.3 Transmission timing adjustments

**<Unchanged parts are omitted>**

In other cases, a 6-bit timing advance command [8] or timing advance adjustment in DCI format 6-0A/B if present, *TA*, for a TAG indicates adjustment of the current *NTA* value, *NTA,old*, to the new *NTA* value, *NTA,new*, by index values of *TA* = 0, 1, 2,..., 63, where *NTA,new* = *NTA,old* + (*TA* −31)×16. Here, adjustment of *NTA* value by a positive or a negative amount indicates advancing or delaying the uplink transmission timing for the TAG by a given amount respectively.

**<Unchanged parts are omitted>**

**-----------------------------------------------------End of Text Proposal---------------------------------------------**

## Clarification for “UE-specific search space configured by PUR C-RNTI”

**Issue**: In RAN1 #100bis-e it was discussed whether “MPDCCH improvement” can be combined with PUR, which resulted in the following agreed TP:

|  |
| --- |
| ---------------------------------------------- Text start -------------------------------------------------------9.1.5 MPDCCH assignment procedure **<Unchanged parts are omitted>**For Type1-MPDCCH common search space, Type1A-MPDCCH common search space, Type2-MPDCCH common search space and Type2A-MPDCCH common search space, distributed MPDCCH transmission is used.For MPDCCH UE-specific search space configured by PUR C-RNTI, distributed MPDCCH transmission is used.**<Unchanged parts are omitted>**-------------------------------------------------- Text end ---------------------------------------------------------- |

The statement “For MPDCCH UE-specific search space configured by PUR C-RNTI” is not clear because a USS is not configured by PUR C-RNTI but rather the USS is where MPDCCH with CRC scrambled by PUR C-RNTI may be received.

Ericsson[4] provided the following TP for TS 36.213:

----------------------------------------------------- Text start -----------------------------------------------------------

For Type1-MPDCCH common search space, Type1A-MPDCCH common search space, Type2-MPDCCH common search space and Type2A-MPDCCH common search space, distributed MPDCCH transmission is used.

For MPDCCH UE-specific search space where MPDCCH using DCI format 6-0A/6-0B with CRC scrambled by PUR C-RNTI may be received, distributed MPDCCH transmission is used.

----------------------------------------------------- Text end ------------------------------------------------------------

## Power control correction (editorial)

**Issue**: In RAN1#100b-e, the following TP was agreed in R1-2003157 which introduces double specification in RAN1/RAN2, and is inconsistent with the definition for j=0,1

**<TP2 - TS 36.213, Subclause 4.1.1.1>**

 Otherwise

- is a parameter composed of the sum of a component  provided from higher layers for *j=0,* *1* and *3* and a component  provided by higher layers for *j=0,* *1* and *3* for serving cell . For PUSCH (re)transmissions corresponding to a semi-persistent grant then *j=0* , for PUSCH (re)transmissions corresponding to a dynamic scheduled grant then *j=1,* for PUSCH (re)transmissions corresponding to the random access response grant then *j=2* and for BL/CE UE PUSCH (re)transmission using preconfigured uplink resource then *j=3* and = *p0-UE-PUSCH* in *PUR-Config*. and , where the parameter *preambleInitialReceivedTargetPower* [8] () and  are signalled from higher layers for serving cell .

**</TP>**

Qualcomm[2] propose to remove the added text.

## Inconsistent use of “ACK/fallback indication” phrase

**Issue**: In clause 8.0 and 9.1.5.3 of TS 36.213, the phrase “ACK feedback indication” is used but to be consistent, the phrase “ACK/fallback indication” should be used.

Ericsson[4] provided a TPs for clause 8.0 and 9.1.5.3 TS 36.213:

--------------------------------------------- Text start Section 8.0--------------------------------------------------------

8.0 UE procedure for transmitting the physical uplink shared channel

<Unchanged parts are omitted>

For BL/CE UEs, PUSCH transmission can be scheduled by a MPDCCH with DCI format 6-0A/6-0B, or the transmission can correspond to using preconfigured uplink resource configured by higher layers. Transmission using preconfigured uplink resource is initiated by higher layers as specified in [14], while retransmission of transport blocks transmitted using preconfigured uplink resource are scheduled by a MPDCCH with DCI format 6-0A/6-0B.

For a PUSCH transmission using preconfigured uplink resource, the UE shall use the repetition number determined by the repetition adjustment field according to Table 8-2b and Table 8-2c from the most recent MPDCCH DCI format 6-0A/6-0B with CRC scrambled by PUR C-RNTI for PUR ACK/fallback indication (as defined in [4]) if detected, configured by higher layers otherwise.

-------------------------------------------------- Text end ------------------------------------------------------------

------------------------------------------------- Text start -----------------------------------------------------------

9.1.5.3 Preconfigured Uplink Resource ACK/fallback procedure

If a UE has initiated a PUSCH transmission using preconfigured uplink resource on a given serving cell, and upon detection of a MPDCCH with DCI format 6-0A/6-0B with CRC scrambled by PUR C-RNTI intended for the UE within the PUR search space window as defined in Subclause 9.1.5, and the corresponding DCI is for PUR ACK/fallback indication (as defined in [4]), the UE shall deliver the indication as signalled on the MPDCCH, to the higher layers.

------------------------------------------------- Text end ------------------------------------------------------------

## Remove TM Mode 6 and 9

**Issue**: There is no agreement to explicitly support TM 6 and 9.

Ericsson[4] provided the following TP to TS 36.213:

-------------------------------------------------- Text start --------------------------------------------------------

Table 7.1-9: MPDCCH and PDSCH configured by PUR C-RNTI

|  |  |  |  |
| --- | --- | --- | --- |
| Transmission mode | DCI format | Search Space | Transmission scheme of PDSCH corresponding to MPDCCH |
| **Mode 1** | 6-1A or 6-1B | UE specific by PUR C-RNTI | Single-antenna port, port 0 (see Subclause 7.1.1) |
| **Mode 2** | 6-1A or 6-1B | UE specific by PUR C-RNTI | Transmit diversity (see Subclause 7.1.2) |
|  |  |  |  |
|  |  |  |  |
|  |  |  |

-------------------------------------------------- Text end ---------------------------------------------------------

## Clarification of “after the UE has initiated a PUSCH transmission”

**Issues**: The PUR related statements in clause 9.1.5 TS 36.213 incur in the following issues:

1. “after the UE has initiated a PUSCH transmission using preconfigured uplink resource” is not very specific since it does not clarify how long this “after” lasts.
2. “after the UE has initiated a PUSCH transmission using preconfigured uplink resource” may be misleading since it does not restrict whatever comes next to a particular search space or RNTI.
3. Where “after the UE has initiated a PUSCH transmission using preconfigured uplink resource” is used, the legacy text (which is of the highest interest to most readers) has been made less clear or even obscure.

Ericsson[4] provides the following TP for TS 36.213:

------------------------------------------------- Text start -----------------------------------------------------------

is the number of PRB-pairs configured for MPDCCH UE-specific search space. When =2+4, it is given by the higher layer parameter *numberPRB-Pairs-r13,* and when =2 or =4, it is given by the higher layer parameter *numberPRB-Pairs-r11*, except in case of MPDCCH transmission associated with PUR C-RNTI using MPDCCH UE-specific search space in which case it is given by higher layer parameter *numberPRB-Pairs-PUR*.

, , ,  are determined from Table 9.1.5-3 by substituting the value of  with the value of higher layer parameter *mPDCCH-NumRepetition*, except in case of MPDCCH transmission associated with PUR C-RNTI using MPDCCH UE-specific search space in which case it is given by the value of higher layer parameter *mPDCCH-NumRepetition-PUR*.

The PRB-pairs within a Narrowband corresponding to an MPDCCH-PRB-set are indicated by higher layers and are determined using the description given in Subclause 9.1.4.4.

------------------------------------------------ Text omitted -------------------------------------------------------

For MPDCCH UE-specific search space, Type0-MPDCCH common search space, Type1A-MPDCCH common search space, Type2-MPDCCH common search space and Type2A-MPDCCH common search space locations of starting subframe  are given by where is the th consecutive BL/CE DL subframe from subframe , and , and , and , where

- subframe  is a subframe satisfying the condition , where 

- For MPDCCH UE-specific search space and Type0-MPDCCH common search space,  is given by the higher layer parameter *mPDCCH-startSF-UESS,* except in case of MPDCCH transmission associated with PUR C-RNTI using MPDCCH UE-specific search space in which case it is given by the higher layer *mPDCCH-startSF-UESS-PUR*,

- For Type1A-MPDCCH common search space,  is given by the higher layer parameter *mpdcch-startSF-SC-MCCH*

- For Type2-MPDCCH common search space,  is given by the higher layer parameter *mPDCCH-startSF-CSS-RA-r13*

- For Type2A-MPDCCH common search space,  is given by the higher layer parameter *mpdcch-startSF-SC-MTCH*

- is given by higher layer parameter *mpdcch-Offset-SC-MTCH* for Type2A-MPDCCH common search space, and by higher layer parameter *mPDCCH-Offset-UESS-PUR* in case of MPDCCH transmission associated with PUR C-RNTI using MPDCCH UE-specific search space, and otherwise; and

- is given by higher layer parameter *mPDCCH-NumRepetition* for MPDCCH UE-specific search space and Type0-MPDCCH common search space, except in case of MPDCCH transmission associated with PUR C-RNTI using MPDCCH UE-specific search space in which case it is given by higher layer parameter *mPDCCH-NumRepetition-PUR*, and *mPDCCH-NumRepetition-RA* for Type2-MPDCCH common search space, and *mpdcch-NumRepetitions-SC-MCCH* for Type1A-MPDCCH common search space, and *mpdcch-NumRepetitions-SC-MTCH* for Type2A-MPDCCH common search space and

- , , , are given in Table 9.1.5-3.

------------------------------------------------ Text end ------------------------------------------------------------

## TP for Repetition adjustment

**Description**: Regarding L1 adjustment on the PUSCH repetition number, RAN1 sent a replied LS (R1-2002846) to RAN2 in RAN1#100bis-e. The major content of the LS is :

|  |
| --- |
| *… (Copied from R1-2002846)…*RAN1 considers that the answers to the questions above are covered through the following response:* The L1 adjustment on the (N)PUSCH repetition number is intended to apply for future PUR UL transmissions until a new L1 adjustment or RRC reconfiguration is received, i.e. the UE uses the information from the most recently received L1 adjustment or RRC (re)configuration.
* The decision on whether the L1 adjustment on the (N)PUSCH repetition number is intended to update the higher layer (i.e. RRC) configuration or to be used instead of the configuration provided by higher layers can be made in RAN2, and then RAN1 will update the RAN1 specifications in accordance with the RAN2 decision if needed.
 |

Qualcomm [2] proposed two alternative modifications to TS 36.213 to capture this, depending on whether the “storing” behavior is described in RAN1 (TP1-PHY) specifications or RAN2 (TP1-RRC) specifications

## TP for collision between paging SS and PUR

**Issue**: Regarding PUR collision handling, the following WA was made in RAN1#100bis-e and an LS was sent to RAN2 for confirmation.

|  |
| --- |
| Working Assumption* When PUR transmission overlaps with WUS, PUR transmission is prioritized
	+ For eMTC, this applies only to HD-FDD UEs
* When PUR SS monitoring overlaps with Paging CSS, PUR SS monitoring is prioritized
* When PUR SS monitoring overlaps with WUS, PUR SS monitoring is prioritized

If it is concluded by RAN2 that the working assumption is feasible, the working assumption will be automatically confirmed.[**R1-2002944**](file:///D%3A%5CMix-Local%5C001-Mix%20Working%20Folder%5C202005-RAN1%23101-Greece-Athens%20%28e-Meeting%29%5CDocs%5CR1-2002944.zip) **LS on PUR working assumption for NB-IoT and eMTC RAN1, Huawei**AgreementThe LS to RAN2 on PUR working assumption for NB-IoT and eMTC is approved. |

To accelerate the progress, Huawei[1] recommends we develop a TP before getting the response back from RAN2.

## Support of PDCCH order

**Issue:** PDCCH Order is currently not supported by PUR but has advantages vs fallback as outlined by ZTE [3].

1. For D-PUR in RRC\_IDLE mode, PDCCH order is supported and is used to trigger non-contention-based random access procedure by eNB.

# Summary

|  |  |  |
| --- | --- | --- |
| **Issue** | **FL View** | **Company’s view on priority and comments** |
| 1. Sub-PUR allocation for retransmissions
 | Email discussion  |  |
| 1. PUCCH power control
 | Email discussion  |  |
| 1. Power control accumulation mechanism
 | Email discussion |  |
| 1. Timing advance adjustment via DCI
 | Email discussion  |  |
| 1. Power control correction (editorial)
 | Editorial  |  |
| 1. Inconsistent use of “ACK/fallback indication” phrase
 | Editorial  |  |
| 1. Clarification for “UE-specific search space configured by PUR C-RNTI”
 | Lower priority |  |
| 1. Remove TM Mode 6 and 9
 | Lower priority |  |
| 1. Clarification of “after the UE has initiated a PUSCH transmission”
 | Lower priority |  |
| 1. TP for Repetition adjustment
 | Wait for RAN2 LS |  |
| 1. TP for collision between paging SS and PUR
 | Wait for RAN2 LS |  |
| 1. Support of PDCCH order
 | Non-essential feature |  |

The tdocs identified 12 issues which is far more than the number of email discussions possible for this meeting, so prioritization of the issues is required. As FL, the following three topics are initially suggested for email discussion:

* **Email discussion#1:** Issue#1Sub-PUR allocation for retransmissions
* **Email discussion#2:** Power Control (Issue #2 PUCCH power control and Issue #3 Power control Accumulation mechanism)
* **Email discussion#3:** Issue #4 Timing advance adjustment via DCI

If all companies agree, the following issues can be proposed directly to the editor as editorial changes:

* Issue #5: Power control correction (editorial)
* Issue #6: Inconsistent use of “ACK/fallback indication” phrase

# References

1. [R1-2003539](file:///C%3A%5CUsers%5Cgvos%5CDesktop%5C3gpp%5CRAN%5CRAN1%5CTSGR1_101e%5CDocs%5CR1-2003539.zip) Corrections on transmission in preconfigured UL resources Huawei, HiSilicon
2. [R1-2003781](file:///C%3A%5CUsers%5Cgvos%5CDesktop%5C3gpp%5CRAN%5CRAN1%5CTSGR1_101e%5CDocs%5CR1-2003781.zip) Support for transmission in preconfigured UL resources Qualcomm Incorporated
3. [R1-2003791](file:///C%3A%5CUsers%5Cgvos%5CDesktop%5C3gpp%5CRAN%5CRAN1%5CTSGR1_101e%5CDocs%5CR1-2003791.zip) Remaining issues for transmission in preconfigured UL resources for MTC ZTE
4. [R1-2004655](file:///C%3A%5CUsers%5Cgvos%5CDesktop%5C3gpp%5CRAN%5CRAN1%5CTSGR1_101e%5CDocs%5CR1-2004655.zip) Corrections for Preconfigured UL resources for LTE-MTC Ericsson
5. R1-2003157, Corrections to Additional MTC Enhancements for LTE, Rel-16, 36.213, 16.1.0, LTE\_eMTC5-Core, CR#1333