**3GPP TSG RAN WG1 #102-e R1-200----**

**e-Meeting, August 17th – 28th, 2020**

**Agenda item:** 6.2.1 Maintenance of Additional MTC Enhancements

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

**Title:** Feature lead email summary [102-e-LTE-eMTC5-02]

**Document for**: Discussion

# Introduction

This contribution includes the summary for email discussion:

[102-e-LTE-eMTC5-02] PUR clarifications – Gus (Sierra Wireless)

#1 Sub-PRB allocation ([R1-2005469](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005469.zip) section 2.2)

#2 NB-IoT alignment of “after the UE has initiated a PUSCH” ([R1-2005555](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2005555.zip) section 2.2)

#3 Define sequence-group-hopping behavior ([R1-2006417](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_102%5CDocs%5CR1-2006417.zip) section 2)

Discussions/Agreements by 8/21, TPs by 8/28

# Issue #1 Sub-PRB allocation

## Issue Description

Currently in TS36.213 clause 8.1.6 uplink resource allocation type 5, the UE behavior for PUR is not considered.

## Text proposal

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* START TS 36.213\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

**8.1.6 Uplink resource allocation type 5**

Uplink resource allocation type 5 is applicable for BL/CE UEs configured with higher layer parameter *ce-PUSCH-SubPRB-Config-r15* or *PUR-Config*.

The resource allocation information for uplink resource allocation type 5 indicates to a scheduled UE

- a set of contiguously allocated subcarriers within an allocated resource block of a narrowband,

- a number of resource units () determined by the 'number of resource units' field in the corresponding DCI or higher layer parameter *numRUs* in *PUR-Config* according to Table 8.1.6-2 for UE configured with CEModeA, and Table 8.1.6-3 for UE configured with CEModeB.

For a UE configured with CEModeA and the value of the 'number of resource units' field in the scheduling grant set to other than '00', the allocated resource block within a narrowband is given by  where  is the value of the 'resource allocation' field in the scheduling grant, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1. For a UE configured with CEModeA and the value of higher layer parameter *numRUs* in *PUR-Config* set to other than '00', the allocated resource block within a narrowband is given by  where  is indicated by higher layer parameter *prb-AllocationInfo* in *PUR-Config*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1. For PUSCH sub-PRB allocation in CE Mode A, the UE shall consider the DCI valid even if the number of transmitted subframes is greater than *pusch-maxNumRepetitionCEmodeA*.

For a UE configured with CEModeB and the value of the 'sub-PRB allocation flag' field in the scheduling grant set to '1', the allocated resource block within a narrowband is given by the higher layer parameter *locationCE-ModeB*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1.

For a UE configured with CEModeB and the value of higher layer parameter *subPRB-Allocation* in *PUR-Config* set to '1', the allocated resource block within a narrowband is given by higher layer parameter *locationCE-ModeB* in *PUR-Config*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1.

In Table 8.1.6-1,  is the physical-layer cell identity as given in subclause 6.11 of [3].

Table 8.1.6-1: Subcarriers allocation for BL/CE UE.

|  |  |  |
| --- | --- | --- |
| = value of resource allocation field or indicated by higher layer parameter *prb-AllocationInfo* in *PUR-Config* | Modulation | Set of Allocated subcarriers |
| 0 | π/2-BPSK |  |
| 1 | π/2-BPSK |  |
| 2 | π/2-BPSK |  |
| 3 | π/2-BPSK |  |
| 4 | QPSK | 0,1,2 |
| 5 | QPSK | 3,4,5 |
| 6 | QPSK | 6,7,8 |
| 7 | QPSK | 9,10,11 |
| 8 | QPSK | 0,1,2,3,4,5 |
| 9 | QPSK | 6,7,8,9,10,11 |

Table 8.1.6-2: Number of resource units for CEModeA.

|  |  |
| --- | --- |
| Value of 'number of resource units' field or value of higher layer parameter *numRUs* in *PUR-Config*  | Number of resource units |
| '01' | 1 |
| '10' | 2 |
| '11' | 4 |

Table 8.1.6-3: Number of resource units for CEModeB.

|  |  |
| --- | --- |
| Value of 'number of resource units' field or value of higher layer parameter *numRUs* in *PUR-Config*  | Number of resource units |
| '0' | 2 |
| '1' | 4 |

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* END TS 36.213\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

## Company Views

Please indicate your comments to the text proposal:

|  |  |
| --- | --- |
| **Company** | **Comments on Proposal** |
| Ericsson | We are fine with the technical content of the above TP. The only comment we have is on the statement “and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1.” It seems that ideally there should be a HL parameter for the allocated subcarriers (I think this is the case for NB-IoT) since they are also pre-configured, however checking 36.331 there is no such a parameter. Perhaps there is no other way than communicating the missing parameter to RAN2, unless a wording like the following one could be used to solve the issue: “and the allocated subcarriers within the allocated resource block are preconfigured from Table 8.1.6-1.”Please note that the above statement appears twice in the TP since it is used for both CE Mode A and CE Mode B. |
| ZTE,Sanechips |  Regarding the issue Ericsson brought up, in order to find out the allocated subcarriers, the UE only needs to know  and the modulation, both are preconfigured by the higher already. There is no missing link here. Therefore we feel there is no problem with the statement‘allocated subcarriers within the allocated resource block is given in Table 8.1.6-1’ .  |
| Qualcomm | Some comments:We understand the intention here is to make this applicable to UEs configured with SubPRB in connected mode (legacy parameter) or with PUR-Config. Thus, we think the “and” should be an “or”.Now, for the discussion between ZTE and Ericsson, we have a similar view as ZTE, with one minor issue: the referenced tables include the name of the DCI field:Table 8.1.6-1: Subcarriers allocation for BL/CE UE.

|  |  |  |
| --- | --- | --- |
| = value of resource allocation field  | Modulation | Set of Allocated subcarriers |
| 0 | π/2-BPSK |  |
| 1 | π/2-BPSK |  |
| 2 | π/2-BPSK |  |
| 3 | π/2-BPSK |  |
| 4 | QPSK | 0,1,2 |
| 5 | QPSK | 3,4,5 |
| 6 | QPSK | 6,7,8 |
| 7 | QPSK | 9,10,11 |
| 8 | QPSK | 0,1,2,3,4,5 |
| 9 | QPSK | 6,7,8,9,10,11 |

Table 8.1.6-2: Number of resource units for CEModeA.

|  |  |
| --- | --- |
| Value of 'number of resource units' field | Number of resource units |
| '01' | 1 |
| '10' | 2 |
| '11' | 4 |

Table 8.1.6-3: Number of resource units for CEModeB.

|  |  |
| --- | --- |
| Value of 'number of resource units' field | Number of resource units |
| '0' | 2 |
| '1' | 4 |

Maybe it would be a good approach to also add an “OR” to reference the RRC parameter for PUR, or add a reference in the text.Couple of editorial comments:- The RRC parameters should be in italics and without quotes, e.g.- If there is no confusion, I think the typical approach is to not include the “-r16” in the RAN1 specifications.- When referring to higher layer parameters, we should probably use the word “parameter” instead of “field”, or nothing at all (e.g higher layer parameter *subPRB-Allocation* in *PUR-Config*). |
| Ericsson v007 | I think I know what is causing a confusion here: For sub-PRB in CE Mode A, within the “Resource block assignment” field we have “+6 bits”, the 6 bits are indeed “” (See TS 36.212 clause 5.3.3.1.10) however in the TP above it is stated that “ is the value of the 'prb-AllocationInfo-r16' field in *PUR-Config*”, if we go to TS 36.331 the “prb-AllocationInfo-r16” field for CE Mode A is 10 bits rather than 6 bits.For sub-PRB in CE Mode B the situation is similar (i.e., +4 bits), it is just that within the “Resource block assignment” field 4 bits are used for the purpose of selecting any of the 10 choices in Table 8.1.6-1, see TS 36.212 clause 5.3.3.1.11. |
| ZTE,Sanechips | Please see the updated TP below this table. We have made the following changes:1. Taken into account the comment for replace ‘and’ with ‘or’
2. Taken into account QC second comment and modified the name in the referenced table
3. Taken into account the third QC comment regarding ‘-r16’ .
4. We agree with Ericsson’s comment that the bit number that  and 'prb-AllocationInfo-r16' respectively corresponds to, are different. Therefore some changes are needed here.

 Note in TS36.331, we have the following description:***pur-GrantInfo***Indicates UL grant for transmission using PUR. Field set to *ce-ModeA* indicates the PUR grant is for CE Mode A and the field set to *ce-ModeB* indicates the PUR grant is for CE Mode B. *numRUs* indicates DCI field for PUSCH number of resource units, see TS 36.213 [23] clause 8.1.6. *prbAllocationInfo* indicates DCI field for PUSCH resource block assignment, see TS 36.212 [22], clause 5.3.3.1.10 (CE Mode A) and clause 5.3.3.1.11 (CE Mode B). *mcs* indicates DCI field for PUSCH modulation and coding scheme, see TS 36.213 [23] clause 8.6. *numRepetitions* indicates DCI field for PUSCH repetition number, see TS 36.213 [23] clause 8.0.For CE Mode A, numRUs set to '00' indicates use of full-PRB resource allocation, otherwise sub-PRB resource allocation as defined in TS 36.213 [23], clause 8.1.6. For CE Mode B, subPRB-Allocation indicates whether sub-PRB resource allocation is used.This means for PUR, the information for 6 bits ‘resource allocation fields’ for CE mode A , or the 4 bits for CE mode B, can be indicated via ‘prb-AllocationInfo-r16’. Therefore we change the wording to where  is indicated by higher layer parameter *prb-AllocationInfo* in *PUR-Config* in the TP below. |
| FL  | Copy ZTE TP below to main proposal in section 2.2 |
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 **ZTE Update TP:**

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* START TS 36.213\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

**8.1.6 Uplink resource allocation type 5**

Uplink resource allocation type 5 is applicable for BL/CE UEs configured with higher layer parameter *ce-PUSCH-SubPRB-Config-r15* or *PUR-Config*.

The resource allocation information for uplink resource allocation type 5 indicates to a scheduled UE

- a set of contiguously allocated subcarriers within an allocated resource block of a narrowband,

- a number of resource units () determined by the 'number of resource units' field in the corresponding DCI or higher layer parameter *numRUs* in *PUR-Config* according to Table 8.1.6-2 for UE configured with CEModeA, and Table 8.1.6-3 for UE configured with CEModeB.

For a UE configured with CEModeA and the value of the 'number of resource units' field in the scheduling grant set to other than '00', the allocated resource block within a narrowband is given by  where  is the value of the 'resource allocation' field in the scheduling grant, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1. For a UE configured with CEModeA and the value of higher layer parameter *numRUs* in *PUR-Config* set to other than '00', the allocated resource block within a narrowband is given by  where  is indicated by higher layer parameter *prb-AllocationInfo* in *PUR-Config*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1. For PUSCH sub-PRB allocation in CE Mode A, the UE shall consider the DCI valid even if the number of transmitted subframes is greater than *pusch-maxNumRepetitionCEmodeA*.

For a UE configured with CEModeB and the value of the 'sub-PRB allocation flag' field in the scheduling grant set to '1', the allocated resource block within a narrowband is given by the higher layer parameter *locationCE-ModeB*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1.

For a UE configured with CEModeB and the value of higher layer parameter *subPRB-Allocation* in *PUR-Config* set to '1', the allocated resource block within a narrowband is given by higher layer parameter *locationCE-ModeB* in *PUR-Config*, and the allocated subcarriers within the allocated resource block is given in Table 8.1.6-1.

In Table 8.1.6-1,  is the physical-layer cell identity as given in subclause 6.11 of [3].

Table 8.1.6-1: Subcarriers allocation for BL/CE UE.

|  |  |  |
| --- | --- | --- |
| = value of resource allocation field or indicated by higher layer parameter *prb-AllocationInfo* in *PUR-Config* | Modulation | Set of Allocated subcarriers |
| 0 | π/2-BPSK |  |
| 1 | π/2-BPSK |  |
| 2 | π/2-BPSK |  |
| 3 | π/2-BPSK |  |
| 4 | QPSK | 0,1,2 |
| 5 | QPSK | 3,4,5 |
| 6 | QPSK | 6,7,8 |
| 7 | QPSK | 9,10,11 |
| 8 | QPSK | 0,1,2,3,4,5 |
| 9 | QPSK | 6,7,8,9,10,11 |

Table 8.1.6-2: Number of resource units for CEModeA.

|  |  |
| --- | --- |
| Value of 'number of resource units' field or value of higher layer parameter *numRUs* in *PUR-Config*  | Number of resource units |
| '01' | 1 |
| '10' | 2 |
| '11' | 4 |

Table 8.1.6-3: Number of resource units for CEModeB.

|  |  |
| --- | --- |
| Value of 'number of resource units' field or value of higher layer parameter *numRUs* in *PUR-Config*  | Number of resource units |
| '0' | 2 |
| '1' | 4 |

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* END TS 36.213\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

# Issue #2 NB-IoT alignment of “after the UE has initiated a PUSCH”

## Issue Description

In RAN1 #101e for NB-IOT, the clause “after the UE has initiated a NPUSCH transmission using preconfigured uplink resource” in TS 36.213 was discussed given the ambiguity of the term “after” . The resulting changes can be observed in clause 16.6 of R1-2005178. There is a need to do similar changes for LTE-M and also some alignment to TS 36.331 parameter names.

## Text proposal

------------------------------------------------- Text start (TS 36.213 Clause 9.1.5)-----------------------------------------

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 for MPDCCH candidates associated with PUR C-RNTI in which case it is given by the higher layer parameter *mpdcch-PRB-Pairs-r16* in *PUR-Config*.

, , ,  are determined from Table 9.1.5-3 by substituting the value of  with the value of higher layer parameter *mPDCCH-NumRepetition*, except for MPDCCH candidates associated with PUR C-RNTI in which case it is given by the value of the higher layer parameter *mpdcch-NumRepetition-r16* in *PUR-Config*.

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 (TS 36.213 Clause 9.1.5)-----------------------------------------

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 for MPDCCH candidates associated with PUR C-RNTI in which case it is given by the higher layer parameter *mpdcch-startSF-UESS-r16* in *PUR-Config*,
* - 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 the higher layer parameter *mpdcch-Offset-SC-MTCH* for Type2A-MPDCCH common search space, and by the higher layer parameter *mpdcch-Offset-PUR-SS-r16* in *PUR-Config* for MPDCCH candidates associated with PUR C-RNTI , and otherwise; and

- is given by the higher layer parameter *mPDCCH-NumRepetition* for MPDCCH UE-specific search space and Type0-MPDCCH common search space, except for MPDCCH candidates associated with PUR C-RNTI in which case it is given by the higher layer parameter *mpdcch-NumRepetition-r16* in *PUR-Config*, 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 (TS 36.213 Clause 9.1.5)------------------------------------------

## Company Views

Please indicate your comments to the text proposal:

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| --- | --- |
| **Company** | **Comments on Proposal** |
| Ericsson | Fine, the TP above is just intended to align for LTE-MTC the agreements made in RAN1 #101e for NB-IoT. |
| Huawei/HiSilicon | Ok with the TP |
| LG | We are okay with the TP. |
| ZTE,Sanechips | Don't’ have strong view about the need for this TP , but we can go with the majority. |
| Nokia | Ok with the TP |
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# Issue #3 Define sequence-group-hopping behavior

## Issue Description

Sequence-group hopping for PUSCH can be disabled through the higher-layer parameter *Disable-sequence-group-hopping* despite being enabled on a cell basis except for PUSCH transmission for Random Access Response Grant. Since the *Disable-sequence-group-hopping* is not included in *PUR-Config* so this functionality is not supported for PUR. Generally, there are two alternatives to solve this issue:

* Alt 1: Send LS to RAN2 to include *Disable-sequence-group-hopping* in *PUR-Config* so this functionalty can be support for PUR.
* Alt 2: Modify RAN1 specification (see TP below) so that PUR is treated similar to RACH.
* Alt 3: Agree to a conclusion such that *Disable-sequence-group-hopping* can never be configured for PUR:

*Proposed conclusion:*

*For PUR transmissions, the Disable-sequence-group-hopping feature is not supported.*

## Text proposal

This TP is to specify that PUR transmission on PUSCH are treated similar to RACH WRT Sequence-group hopping behaviour.

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* START TS 36.211\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

**5.5.1.3 Group hopping**

The sequence-group number  in slot  is defined by a group hopping pattern  and a sequence-shift pattern  according to



There are 17 different hopping patterns and 30 different sequence-shift patterns. Sequence-group hopping can be enabled or disabled by means of the cell-specific parameter *Group-hopping-enabled* provided by higher layers. Sequence-group hopping for PUSCH can be disabled for a certain UE through the higher-layer parameter *Disable-sequence-group-hopping* despite being enabled on a cell basis unless the PUSCH transmission corresponds to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure or the PUSCH transmission corresponds to preconfigured uplink resources.

**<\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* END TS 36.211\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*>**

## Company Views

Please indicate your preference ALT1 or ALT2 and any comments to the text proposal:

|  |  |
| --- | --- |
| **Company** | **Comments on Proposal** |
| Ericsson | If *Disable-sequence-group-hopping* is not in PUR-Config, then an exception for it cannot be created. Perhaps HW’s intention was to say that Sequence-group hopping if enabled cannot be disabled for PUR. It seems that no change is needed, but we are open to see a suggestion, if there were one. |
| Huawei/HiSilicon | Alt2.Our concern is that the following underlined sentence in the current spec is incorrect for PUR, since *Disable-sequence-group-hopping* is not included in *PUR-Config*. And the part after “ unless …” only covers RACH.* “Sequence-group hopping for PUSCH can be disabled for a certain UE through the higher-layer parameter *Disable-sequence-group-hopping* despite being enabled on a cell basis unless the PUSCH transmission corresponds to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure”

So we think the parts both before and after “ unless …” do not apply to PUR, resulting in PUR unspecified in this case.We prefer sequence-group hopping for PUSCH should not be disabled for PUR if being enabled on a cell basis. And we also think Alt 1 has RRC impact, and is not preferred at this maintenance phase.So we support Alt2 to make the spec complete. |
| LG | We have a similar view with Ericsson in that the sentence starting with “Sequence-group hopping for PUSCH can be disabled …” describes the case where the sequence group hopping can be disabled. As the sequence group hopping can only be disabled through the higher-layer parameter, if it is not configured as in PUR, disabling the sequence group hopping is not supported. With that understanding, we don’t think the proposed change is needed. |
| Moderator (Sierra) | Given LG and E// view, I added ALT3 * Alt 3: Agree to a conclusion such that *Disable-sequence-group-hopping* can never be configure for PUR:

For PUR transmissions, the *Disable-sequence-group-hopping* feature is not supported. |
| ZTE,Sanechips | It seems alt3 is the interpretation of the current specification. We are fine with it, but we don’t think any TP is needed here. |
| Qualcomm | Agree with the moderator. We can probably have the same conclusion for NBIOT. |
| Ericsson v007 | We are fine with the proposed “Conclusion” from the FL. |
| Nokia | Agree with alt3. For the chair’s notes where I guess the conclusion will be captured, just a typo, “*can never be configured for PUR*” |
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# Summary

{TBD}

# References

1. R1-2005555 PUR maintenance issues for Rel-16 LTE-MTC Ericsson
2. R1-2005815 Corrections regarding RAN2 LS reply on PUR Huawei, HiSilicon
3. R1-2006187 Maintenance on PUR Qualcomm Incorporated
4. R1-2006417 Corrections on transmission in preconfigured UL resources for eMTC Huawei, HiSilicon
5. R1-2005469 Remaining issues for transmission in preconfigured UL resources for MTC ZTE