**3GPP TSG RAN WG1 Meeting #107 R1-21xxxxx**

**e-Meeting, November 11th – 19th, 2021**

**Agenda Item: 8.9**

**Source: Moderator (Huawei)**

**Title: Feature lead summary on 107-e-R17-RRC-NB-IoT-eMTC**

**Document for: Discussion and Decision**

# Introduction

In email discussion of RAN1#106bis-e, there were discussion on RRC parameters for the WI [1]. And the list of stable rows was endorsed in [2].

This documents provides the proposals and summary of discussions of the corresponding email discussion on RRC parameters.

[106bis-e-R17-RRC-NB-IoT-eMTC] Email discussion on Rel-17 RRC parameters for Rel-17 NB-IoT and eMTC – Yubo (Huawei)

The RRC parameter list is also attached: [RAN1#107-e\_Rel-17\_RRC\_NB-IoT\_eMTC\_v2.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_107-e/Inbox/drafts/8.9/RRC/RAN1%23107-e_Rel-17_RRC_NB-IoT_eMTC_v2.xlsx).

# Discussion

## Support of 16-QAM for unicast in UL and DL for NB-IoT

**Issue 1-1: Configuration of PUR**

For the configuration of NPUSCH for PUR, the two rows below are marked as stable.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.211, 36.213 |  |  |  | enable16QAM-ul in PUR-config-NB | New | enable 16QAM for NPUSCH in PUR procedure | Enable/disable the use of 16QAM for NPUSCH in PUR procedure | Enable | disable | Per UE | UE specific | 36.331 | According to the following agreement, the configurations are up to RAN2, including the MCS indices, RU indices and UL power control parameter:  Agreement To support 16-QAM for NPDSCH and NPUSCH in PUR procedure, • 16-QAM can be enabled/disabled by UE specific RRC signaling for NPDSCH and NPUSCH separately • The corresponding configurations and signaling details are up to RAN2 |
| NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.211, 36.213 |  |  |  | enable16QAM-dl in PUR-config-NB | New | enable 16QAM for NPDSCH in PUR procedure | Enable/disable the use of 16QAM for NPDSCH in PUR procedure | Enable | disable | Per UE | UE specific | 36.331 | According to the following agreement, the configurations are up to RAN2, including the configuration of power allocation:  Agreement To support 16-QAM for NPDSCH and NPUSCH in PUR procedure, • 16-QAM can be enabled/disabled by UE specific RRC signaling for NPDSCH and NPUSCH separately • The corresponding configurations and signaling details are up to RAN2 |

Please input your comments for the above proposal:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | We are Ok with it. |
| Qualcomm | OK |
| Nokia, NSB | OK |
| Lenovo, MotoM | OK |
| ZTE, Sanechips | OK |

**Issue 1-2: Configuration for downlink power allocation**

For the following rows for configuration of power allocation:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.213 |  |  |  | NPDSCH-NRS-PowerRatio | New | Power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS | the Power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS for standalone and guard-band deployments, or in symbols without NRS nor CRS for in-band deployments | FFS |  | Per UE | UE specific | 36.331 | Confirm working assumption: Working Assumption For downlink power allocation to support 16QAM: • For standalone and guard-band deployments: o One power ratio is signaled optionally § NPDSCH EPRE to NRS EPRE in symbols without NRS o The same transmit power is assumed across different symbols. o If the signalling is not indicated, the legacy power allocation is used. § i.e., the ratio of NPDSCH EPRE to NRS EPRE is 0dB for one NRS antenna port, and -3dB for two NRS antenna ports • UE specific signalling is used |
| NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.213 |  |  |  | NPDSCH-NRS-PowerRatio-withCRS | New | Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS | the Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS for inband deployments | FFS |  | Per UE | UE specific | 36.331 | Agreement Confirm the following working assumption: For downlink power allocation to support 16QAM: • For inband deployments, a power ratio is signaled in addition to the signalling for standalone and guard-band deployments which in this case applies to “symbols with NRS” and “symbols without NRS nor CRS”.  o the power ratio between NPDSCH EPRE and NRS EPRE in symbols with CRS is signalled o the signalling is UE specific Note: “symbols with NRS” and “symbols without NRS nor CRS” have the same power. |

There is following proposal

|  |  |
| --- | --- |
| Sourcing | Proposals |
| [3] | **Proposal 6: The value range for RRC parameter power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS should be {-6, -4.77, -3, -1.77, 0, 1, 2, 3} dB.** |

Please input your comments on the value range of the higher layer parameters for power allocation:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | Proposal 6 refers to the power ratio of “NPDSCH EPRE to NRS EPRE in symbols without NRS”, is the right understanding that the same set of values is being proposed to be used for “the Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS”? |
| Qualcomm | We agree with Ericsson that it would be good to clarify the ranges for both types of symbols. |
| Nokia, NSB | We are fine with the proposed range for NPDSCH EPRE to NRS EPRE in symbols without NRS |
| Lenovo, MotoM | We are fine with the proposed range for both types of symbols. (e.g., NPDSCH EPRE to NRS EPRE in **all** symbols without NRS) |
| ZTE, Sanechips | We are OK with the range clarification. |
| Moderator (Huawei) | Based on the comments, the proposal is updated as:  **Proposal: The value range for following RRC parameters is {-6, -4.77, -3, -1.77, 0, 1, 2, 3} dB**   * **power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS** * **Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS** |
| Ericsson v009 | We are fine with the updated proposal, for which we suggest the following updates to make it consistent with the list in Excel:  **Proposal: The value range for the following RRC parameters is {-6, -4.77, -3, -1.77, 0, 1, 2, 3} dB**   * **Power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS** **for standalone and guard-band deployments, or in symbols without NRS nor CRS for in-band deployments.** * **Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS for in-band deployments.** |
| Moderator (Huawei) | The update from Ericsson seems reasonable to me, therefore, the following is proposed:  **Proposal: The value range for the following RRC parameters is {-6, -4.77, -3, -1.77, 0, 1, 2, 3} dB**   * **Power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS** **for standalone and guard-band deployments, or in symbols without NRS nor CRS for in-band deployments.** * **Power ratio of NPDSCH EPRE to NRS EPRE in symbols with CRS for in-band deployments.**   In addition, the value ranges in the excel file for the corresponding parameters are also updated accordingly. |

**Issue 1-3: Configuration for uplink power control**

It has been agreed as below:

**Agreement**

**The following working assumption is confirmed.**

**For the new term** **introduced for power control of NPUSCH,**



* Reuse the LTE definition simplified for NB-IoT:  for  and  for , where  is given by higher layer parameter *deltaMCS-Enabled*, and  where K is the code block size.



* FFS: whether the new term applies to QPSK when configured with 16QAM, if it does not, whether an additional term is introduced to avoid jump between QPSK and 16QAM

Then the row for the configuration of uplink power control can be marked as stable, as below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.213 |  |  |  | deltaMCS-Enabled | New | Ks for uplink power control of NPUSCH | the parameter Ks of uplink power control of NPUSCH | {en0, en1}, where en0 corresponds to value 0 corresponding to state "disabled", en1 correponds to value 1.25 corresponding to "enabled" | en0 | Per UE | UE specific | 36.331 | Agreement The following working assumption is confirmed. For the new term ∆\_(TF,c) introduced for power control of NPUSCH,  Reuse the LTE definition simplified for NB-IoT: ∆\_(TF,c) (i)=10log\_10 ((2^(BPRE∙K\_s )-1)) for K\_s=1.25 and ∆\_(TF,c) (i)=0 for K\_s=0, where K\_s is given by higher layer parameter deltaMCS-Enabled, and BPRE=K/N\_RE where K is the code block size. FFS: whether the new term applies to QPSK when configured with 16QAM, if it does not, whether an additional term is introduced to avoid jump between QPSK and 16QAM |

Please input your comments on the above row:

|  |  |
| --- | --- |
| Companies | Comments |
|  |  |
|  |  |
|  |  |

**Issue 1-4: Others**

Please input your comments on issues other than the above ones:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | None |
|  |  |
|  |  |

## Support additional PDSCH scheduling delay for introduction of 14-HARQ processes in DL for eMTC

Please input your comments in below table:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | None |
|  |  |
|  |  |

## Support a maximum DL TBS of 1736 bits as a Rel-17 optional UE capability

Please input your comments in below table:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | Due that RAN2 has agreed to support PUR for this feature, we will need to add a parameter to Enable/Disable it (Similar to what has been done for 16-QAM). |
| Moderator (Huawei) | There was discussion a bit in last meeting (R1-2108684). The understanding was that if eNB wants to enable max DL TBS, it just schedules TBS larger than 1000 bits as long as UE indicates support it. The support of max DL TBS of 1736 bits has no impact on DCI, therefore, there’s no ambiguity between eNB and UE without the configuration. |
| Ericsson v009 | Thanks for the clarification, we are ok with the approach described above. |

# Summary

# References

1. R1-2110650 Feature lead summary on 106bis-e-R17-RRC-NB-IoT-eMTC, Moderator (Huawei), RAN1#106bis-e, Oct., 11th-19th, 2021.
2. R1-2110572 Consolidated higher layers parameter list for Rel-17 LTE, Moderator (Ericsson), RAN1#106bis-e, Oct., 11th-19th, 2021.
3. R1-2110857 Support of 16QAM for unicast in UL and DL in NB-IoT Huawei, HiSilicon
4. R1-2111070 Discussion on 16QAM for NB-IoT ZTE, Sanechips
5. R1-2111133 Support of 16-QAM for NB-IoT Nokia, Nokia Shanghai Bell
6. R1-2111449 Support of 16-QAM for NB-IoT Qualcomm Incorporated
7. R1-2112001 Support 16QAM for NBIoT Lenovo, Motorola Mobility
8. R1-2112300 Discussion on CQI table and NPUSCH power control parameter for 16QAM MediaTek Inc.
9. R1-2112361 Support of 16-QAM for unicast in UL and DL in NB-IoT Ericsson
10. R1-2110858 Support of 14-HARQ processes in DL for HD-FDD MTC UEs Huawei, HiSilicon
11. R1-2111071 Remaining issues on 14-HARQ processes in DL for eMTC ZTE, Sanechips
12. R1-2111134 Support of 14-HARQ processes in DL for eMTC Nokia, Nokia Shanghai Bell
13. R1-2111450 Support of 14 HARQ processes and scheduling delay Qualcomm Incorporated
14. R1-2112362 Support of 14 HARQ processes in DL in LTE-MTC Ericsson
15. R1-2111939 Further considerations on Rel-17 NB-IoT and eMTC enhancements Huawei, HiSilicon
16. R1-2112363 On the support of 16-QAM for unicast in UL and DL in TDD NB-IoT Ericsson