**3GPP TSG RAN WG1 Meeting #106bis-e R1-21xxxxx**

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

**Agenda Item: 8.9**

**Source: Moderator (Huawei)**

**Title: Feature lead summary #1 on 106bis-e-R17-RRC-NB-IoT-eMTC**

**Document for: Discussion and Decision**

# Introduction

In email discussion post RAN1#106-e, there were initial draft of RRC parameters for the WI [1].

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 updated and located at: [RAN1#106bis-e\_Rel-17\_RRC\_NB-IoT\_eMTC\_v002.xlsx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106b-e/Inbox/drafts/8.9/RAN1%23106bis-e_Rel-17_RRC_NB-IoT_eMTC_v002.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, there are two entries in brackets as following in the RRC parameter list.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [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] | 　 |
| [NB\_IOTenh4\_LTE\_eMTC6 | 16QAM for NB-IoT | 36.211, 36.213 | 　 | 　 | 　 | npusch-MCS | FFS New or existing | the TBS index for NPUSCH for PUR | the TBS index for NPUSCH for PUR when 16QAM is configured | 14,15,…,21 | 　 | Per UE | UE specific | 36.331] | 　 |

The following are proposed regarding this issue:

|  |  |
| --- | --- |
| Sourcing | proposals |
| [4] | **Proposal 9: For supporting 16-QAM in PUR procedure,** * **One IE is introduced in pur-PhysicalConfig to enable the use of 16-QAM in NPUSCH**
	+ **The field multiTone in npusch-MCS in PUR NPUSCH configuration is modified to include MCS 0-21.**
* **One IE is introduced in pur-PhysicalConfig to enable the use of 16-QAM in NPDSCH**
	+ **Power ratios of NRS and NPDSCH are given in pur-PhysicalConfig**
 |
| [8] | Proposal 7 To support 16-QAM for NPDSCH and NPUSCH in PUR procedure,* 16-QAM can be enabled/disabled by UE specific RRC signaling in *PUR-Config-NB* for NPDSCH and NPUSCH separately.
	+ When 16-QAM is enabled for NPUSCH, the MCS indices, RU indices and UL power control parameter are indicated in *PUR-Config-NB*.
		- Note1: It’s up to RAN2 whether a new parameter or the legacy parameter is used to indicate the RU indices.
		- Note 2: There may be additional parameters if agreed.
	+ When 16-QAM is enabled for NPDSCH, the DL power allocation is indicated in *PUR-Config-NB*.
 |

For the enabler of 16-QAM for NPUSCH in PUR procedure, based on the inputs, the following is proposed:

Proposal 1: 16-QAM is enabled/disabled for NPUSCH in PUR procedure by a UE specific RRC signaling

* Option 1: in *PUR-config-NB*
* Option 2: in *pur-PhysicalConfig*
* Option 3: up to RAN2

For the indication of MCS indices, the following is proposed:

Proposal 2: If 16-QAM is enabled, the MCS indices of PUR NPUSCH is signaled by:

* Option 1: modification of field *multitone* to include MCS 0~21
* Option 2: a new field to signal the MCS 14~21
* Option 3: up to RAN2

The details of RRC parameters for NPDSCH in PUR procedure can be discussed if it’s agreed.

Please input your comments for the above proposal:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | For both Proposal 1 and Proposal 2, we think that Option-3 (i.e., “up to RAN2”) should be selected, especially because in our undestanding there is already a running CRs on TS 36.331 touching upon the PUR configuration  |
| Nokia, NSB | We don’t have a strong view here and we are OK to leave to RAN2. |
| ZTE, Sanechips | For both proposals, we are OK to leave it to RAN2. |
| Moderator (Huawei) | The followings have been agreedAgreement**Support 16-QAM for NPDSCH in PUR procedure*** **CSI report is not supported/expected during PUR procedure.**

  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**

Therefore, the RRC parameters are updated as below* The brackets for “enable16QAM-ul in PUR-config-NB” are removed, and the above agreement is included in the comment.
* The row of npusch MCS is removed.
* A new row “enable16QAM-ul in PUR-config-NB” is added.
 |
| Lenovo, MotoM | For the RRC parameters update, I am not sure whether we should remove the npusch MCS, although it is up to RAN2. |
| Moderator (Huawei) | @Lenovo, in the comment column, the agreement has copied there, together with other agreements on the NPUSCH MCS, RAN2 should be able to understand RAN1 intention and work on the spec. |

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

The following has been agreed:

 Agreement

**Confirm the following working assumption:**

**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”.**
	+ **the power ratio between NPDSCH EPRE and NRS EPRE in symbols with CRS is signaled**
	+ **the signalling is UE specific**

**Note: “symbols with NRS” and “symbols without NRS nor CRS” have the same power.**

Therefore, the brackets for the row “NPDSCH-NRS-Powerratio-withCRS” are removed:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | AgreementConfirm 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 signalledo the signalling is UE specificNote: “symbols with NRS” and “symbols without NRS nor CRS” have the same power. | unstable |

Please input your comments for the above row:

|  |  |
| --- | --- |
| Companies | Comments |
| Lenovo, MotoM | It can be stable based on the endorsement of Chairman last weekend |
| Ericsson v06 | The update looks Ok based on the recently confirmed Working Assumption. |
| Ericsson v07 | One extra comment is that because of the confirmed Working Assumption (WA) cited above, the 4th row (i.e., the Power ratio of NPDSCH EPRE to NRS EPRE in symbols without NRS) needs to be updated. The WA states “**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”**”. Thus, the descriptions (i.e., column J) can be updated as follows: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”.Moreover, although RAN2 will decide on the final parameter names, I guess we should at least make the following parameters in rows 4 and 5 more readable “NPDSCH-NRS-Powerratio” and “NPDSCH-NRS-Powerratio-withCRS”, perhaps the second of the two adjacent “r” should use a capital letter, that is “NPDSCH-NRS-PowerRatio” and “NPDSCH-NRS-PowerRatio-withCRS”. |
| Moderator (Huawei) | @Ericsson, the suggestion sounds reasonable to me. |

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

This will be discussed once it’s agreed.

**Working Assumption**

**For the new term** $∆\_{TF,c}$ **introduced for power control of NPUSCH,**

* Reuse the LTE definition simplified for NB-IoT: $∆\_{TF,c}\left(i\right)=10log\_{10}\left(\left(2^{BPRE∙K\_{s}}-1\right)\right)$ for $K\_{s}=1.25$ and $∆\_{TF,c}\left(i\right)=0$ for $K\_{s}=0$, where $K\_{s}$ is given by higher layer parameter *deltaMCS-Enabled*, and $BPRE=\frac{K}{N\_{RE}}$ 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

Therefore, a new row is added 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 | Working AssumptionFor 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  | unstable |

Please input your comments for the above row:

|  |  |
| --- | --- |
| Companies | Comments |
| Lenovo, MotoM | We are OK to the new row, and should be stable when confirmed |
| Ericsson v06 | As it has been done for other entries, the row can be highlighted in yellow (i.e., FFS) since the topic is still under Working Assumption. |
| Moderator (Huawei) | It’s highlighted in yellow according to the comments, and it will remain as unstable until it’s confirmed. |

**Issue 1-4: Others**

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

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

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

Please input your comments in below table:

|  |  |
| --- | --- |
| Companies | Comments |
| Lenovo, MotoM | For the RRC parameter excel, “11G”，the parameter doesn’t indicate the detail HARQ-ACK delay value, but the delay count type. Hope to update the parameter name from *ce-HARQ-ACK-delay* to *ce-HARQ-ACK-delay[-count]-type.* For “11K”, the range is updated to {*type1, type2*} accordingly. The parameter name will be used in the draft version specification. |
| Ericsson v06 | Our preference is to keep what we have, since RAN2 will decide on the exact parameter names. Moreover, Alt-1 and Alt-2e are not types, but rather two different HARQ-ACK delay solutions, reason why using “type1, type2” may lead to misunderstandings. We have as place holder “Alt-1, Alt-2e” and in the comment field their corresponding descriptions mapping to those names, so using that information RAN2 can decide how to capture the above in the best way into the Technical Specifications. |
| Moderator (Huawei) | @ Lenovo, it may be better to leave “Alt-1, Alt-2e” there, as all the agreements and comments refer to them as these, it would be easier for RAN2 to understand the exact meaning. The parameter name can be updated to ce-HARQ-ACK-delay-type to make it more clear. |

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

The following are proposed:

|  |  |
| --- | --- |
| Sourcing | proposals |
| [15] | **Proposal 1: Parameters on configuration of the maximum DL TBS for multicast and PUR in eMTC are not needed.** |

Please input your comments in below table:

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | If multicast were supported, there will be an impact in the configuration of SC-MTCH provided via SC-MCCH. Thus, supporting multicast won’t be transparent, and as we expressed in the previous e-meeting, multicast used along with the new DL TBS of 1736 bits does not seem to be a relevant scenario that can provide significant gains as to justify the specification impacts (e.g., there might be very few UEs that implement multicast + larger TBS). Thus, we are only OK with supporting the larger TBS for connected mode features + PUR. |
| Nokia, NSB | We share similar view as Ericsson.  |
| ZTE, Sanechips | We are OK to support PUR with 1736 bits. As for the multicast, we think the larger TBS still has some benefits for multicast transmission. However, we do not have the strong view here and can follow the majority views. |
| Lenovo, MotoM | We share the similar view as Ericsson on not support larger TBS in multicast.For PUR, we don’t think there is any scenarios to support 1736 for PUR PDSCH transmission. But we don’t have strong view and can follow the majority views. |

# Summary

# References

1. R1-2108684, [Post-106-e-Rel17-RRC-09] Summary of email discussion on RRC parameters for Enhancements for NB-IoT and LTE-MTC, Moderator (Huawei), RAN1#106-e, Aug., 16th-27th, 2021.
2. R1-2108777 Support of 16QAM for unicast in UL and DL in NB-IoT Huawei, HiSilicon
3. R1-2109174 Support of 16-QAM for NB-IoT Qualcomm Incorporated
4. R1-2109314 Support of 16-QAM for NB-IoT Nokia, Nokia Shanghai Bell
5. R1-2109320 Support 16QAM for NBIoT Lenovo, Motorola Mobility
6. R1-2109337 Discussion on UL and DL 16QAM for NB-IoT ZTE, Sanechips
7. R1-2109559 Remaining Issues on supporting 16QAM in NB-IOT R17 MediaTek Inc.
8. R1-2110316 Support of 16-QAM for unicast in UL and DL in NB-IoT Ericsson
9. R1-2108778 Support of 14-HARQ processes in DL for HD-FDD MTC UEs Huawei, HiSilicon
10. R1-2109175 Support of 14 HARQ processes and scheduling delay Qualcomm Incorporated
11. R1-2109315 Support of 14-HARQ processes in DL for eMTC Nokia, Nokia Shanghai Bell
12. R1-2109338 Remaining issues on 14-HARQ processes in DL for eMTC ZTE, Sanechips
13. R1-2110317 Support of 14 HARQ processes in DL in LTE-MTC Ericsson
14. R1-2110318 On the support of 16-QAM for unicast in UL and DL for TDD NB-IoT Ericsson
15. R1-2110372 Discussion on RRC parameters for max DL TBS of 1736 bits Huawei, HiSilicon