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

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

**Agenda Item: 7.2.1**

**Source: Moderator (ZTE)**

**Title: Email discussion #2 for 2-step RACH**

**Document for: Discussion**

# Introduction

This document is intended to address the following remaining issues by email discussion.

[102-e-NR-2step-RACH-02] Email discussion/approval of addressing issues #2, #7.2, #8 as in the summary:

* Modulation order of MsgB PDSCH
* Default TDRA table for extended CP
* Resource overhead of MsgA PUSCH

By 8/20, with follow-up potential CR(s) by 8/25 – Li (ZTE)

# Modulation order of MsgB PDSCH (issue #2)

R1-2005605 proposed to limit the modulation order of MsgB PDSCH, similar to the principle of Msg2 PDSCH scheduled with RA-RNTI.

***Proposal 1:***

* Adopt the TP#1 in 38.214, to limit the modulation order of MsgB PDSCH.

**Reasons for change**

To limit the modulation order of MsgB PDSCH, similar to the PDSCH scheduled with RA-RNTI

**Summary of changes**

Implement the above update

**Specs/Sections impacted**

TS 38.214, Section 5.1.3.1

-------------------------**Text proposal #1 starts for TS 38.214** ----------------------------

5.1.3.1 Modulation order and target code rate determination

<Unchanged Text Omitted>

The UE is not expected to decode a PDSCH scheduled with P-RNTI, RA-RNTI, MsgB-RNTI, SI-RNTI and *Qm* > 2

<Unchanged Text Omitted>

------------------------- **Text proposal #1 ends for TS 38.214** -------------------------------

Any comments?

|  |  |
| --- | --- |
| Company | Comments |
| Nokia | OK for TP#1 |
| Intel | It is not clear to us why we need to restrict MsgB PDSCH with QPSK. In our view, MsgB may include RRC message, which is similar to Msg4 and can have large payload size. In this case, higher modulation order can be used to reduce amount of resource for MsgB PDSCH.  Hence, we do not need this TP. |
| Qualcomm | We are ok to support TP#1.  Similar to msg2 PDSCH, msgB PDSCH is scheduled by a group-common DCI and is expected to be decoded by multiple UEs monitoring a same msgB-RNTI. Typically, the payload size of msgB PDSCH is larger than that of msg2 PDSCH. To ensure the reliability of demodulation and decoding, it makes sense to restrict the modulation order in a similar way as msg2 PDSCH. |
| Ericsson | OK. Just one minor comment, msgB-RNTI should be updated to MsgB-RNTI. |
| CATT | We are fine with TP#1 with Ericsson’s editorial change. |
| Apple | We are ok with TP#1. |
| Spreadtrum | We are fine with TP#1. |
| FL | It seems the TP is acceptable to the majority with the editorial change suggested by Ericsson. Hopefully the motivation mentioned by QC can address Intel’s concern. |
| Intel | It is still unclear to us why we need to restrict MsgB PDSCH modulation order to QPSK. Note that MsgB would include a combination of Msg2 and Msg4. When MsgB includes RRC message, which typically has large size, we think it is more appropriate to use higher modulation order for MsgB PDSCH transmission like Msg4. In addition, given that RACH type selection was already defined between 2-step and 4-step RACH, typically 2-step RACH is mainly targeted for cell center UE, who has good coverage. This indicates that higher modulation order would work well for these UEs.  Having said this, we are still not convinced to restrict MsgB PDSCH with QPSK. |
| vivo | We think the TP is not needed. Intel raised a good point.  Since a MsgB PDSCH would include RRC message which may have larger payload than Msg2 PDSCH, it is not necessary to limit the modulation order for MsgB PDSCH as QPSK. |
| Samsung  (copied from email) | I think Gary's arguement is valid.  1. 2step RACH is not for converage-limited UE, thus the msgB PUSCH will not be critially need to be QPSK;  2. msgB with RRC could be as larger as msg.4, thus it should not be limited to QSPK as well.     Regarding the TP, we think it may not be necessarily needed. it only affects UE implementation (gNB could schedule with QPSK always as it likes), and UE may need to prepare to decode PDSCH with higher modulation order. From the information of RAN2, it seems when successRAR with RRC message, it targets to single UE. Not sure what is the exact reason why it is being removed by RAN, but it seems like a normal PDSCH decoding capability, maybe no need to seperately captured. |
| FL (round 2) | OK. It seems more companies have concerns.  Based on the following RAN2’s reply LS on the MsgB payload size:  MSGB can contain one or more successRAR, one or more fallbackRAR, and can contain one RRC payload. MSGB size without RRC payload is generally comparable in size (i.e. NOT significantly larger compared) to that of Rel-15 Msg2 – the slight difference coming from successRAR being slightly larger than fallbackRAR (4 bytes larger) for the multiplexed case. MSG-B size can be comparable as MSG4 when the RRC payload is included (it should however be noted that the RRC payload is included only for a single UE in given MSGB). Similar to Msg2, RAN2 also assumes MSGB maximum size can be limited by the physical coverage of the cell  For MsgB without RRC payload, it could be similar as Msg2. For MsgB with RRC payload included, multiple companies prefer not to limit the modulation order to Qm <= 2.  Based on the above, I would suggest not to propose TP#1. This can be left to gNB implementation. |
| Qualcomm | We think TP#1 should be kept, because there are fundamental differences between the link budget of msg2/msgB PDSCH and msg4 PDSCH.  When msgB is addressed to msgB-RNTI (or msg2 is addressed to RA-RNTI), it is broadcast to a group of UEs, instead of a single UE. In contrast, msg4 PDSCH is unicast to a single UE.  In R2-2004188, RAN2 mentioned “the NW should use a basic configuration so that msgB can be decoded by all types of UEs and there is no dependence on UE capability.” Within the payload of msg2 or msgB PDSCH, a BI is  always included, and it is expected to be decoded by all the UEs monitoring a same RA-RNTI or a same msgB-RNTI. In determining the MCS for msg2 or msgB PDSCH, network should use a basic configuration that targets the UE with the “worst” link budget. In other words, the UE with the worst link budget may fail to be detected by BS in msg1 or msgA transmission, but it is still expected to decode the entire payload of msg2 or msgB PDSCH, and extract the BI.  On the other hand, msg4 PDSCH is a unicast message, which targets the UE whose msg3 has been successfully decoded. BS is able to select a higher MCS for msg4 PDSCH, based on the link quality of msg3. |
| Ericsson | It is not clear to us the argument that 2-step RACH is not for coverage limited UE, since the RSRP threshold for RA type selection may be low if configured (up to network) when both 2-step and 4-step RA is supported, and the threshold will not be configured when 4-step RACH is not supported, i.e. in 2-step RA only operation.  Not clear on concern of 4 additional bytes from RRC in MsgB either, since SIB1 can have a size up to 2976 bits, but is restricted to *Qm* < 2.  Our understanding is that *Qm* < 2 is applied to those PDSCHs that may be transmitted to multiple UEs. And MsgB is one of them.  Anyway, we’re fine with either way, though we’re a bit prefer to support the TP since we cannot see any good argument to treat MsgB and Msg2 differently with respect to modulation order. |

# Default TDRA table for extended CP (issue #7.2)

R1-2006609 proposed to capture the default TDRA table 6.1.2.1.1-3 for extended CP for MsgA PUSCH, since both normal CP and extended CP are expected be supported for MsgA PUSCH.

***Proposal 2:***

* Adopt the TP#2 in 38.213, to capture the default TDRA table of extended CP for MsgA PUSCH.

**Reasons for change**

To capture the default TDRA table 6.1.2.1.1-3 of extended CP for MsgA PUSCH

**Summary of changes**

Implement the above updates

**Specs/Sections impacted**

TS 38.213 Section 8.1A

-------------------------**Text proposal #2 starts for TS 38.213** ----------------------------

8.1A PUSCH for Type-2 random access procedure

<Unchanged Text Omitted>

If a UE does not have dedicated RRC configuration, or has an initial UL BWP as an active UL BWP, or is not provided *startSymbolAndLengthMsgA-PO*, *msgA-PUSCH-timeDomainAllocation* provides a SLIV and a PUSCH mapping type for a PUSCH transmission by indicating

- first *maxNrofUL-Allocations* values from *PUSCH-TimeDomainResourceAllocationList*, if *PUSCH-TimeDomainResourceAllocationList* is provided in *PUSCH-ConfigCommon*

- entries from table 6.1.2.1.1-2 or table 6.1.2.1.1-3 in [6, TS 38.214], if *PUSCH-TimeDomainResourceAllocationList* is not provided in *PUSCH-ConfigCommon*

<Unchanged Text Omitted>

------------------------- **Text proposal #2 ends for TS 38.213** -------------------------------

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| Nokia | OK for TP#2 |
| Intel | We are fine with the TP |
| Qualcomm | No need to have TP#2. The wording in current release is clear enough. |
| Ericsson | The TP is needed, otherwise we may need agreement to not support ECP for 2-step RACH, while in earlier releases only SIB1 is supposed to only support normal CP.  We’re fine if companies can reach agreement on this normal CP limitation on 2-step RACH, but this means we may need TPs in 38.214 to restrict MsgA PUSCH, MsgB PDSCH to only use default table A for normal CP for uplink and downlink respectively, which might be not pursed by us at this stage.  Our view is to simply follow 4-step RACH and legacy, i.e. simply include the table 6.1.2.1.1-3 table as well as indicated by this TP. |
| CATT | We are fine with TP#2 with ECP support. |
| Apple | We are ok with TP#2. |
| Spreadtrum | We are fine with TP#2. |
| FL | I think the question from Ericsson needs to be addressed. Since we do not have agreement to exclude ECP in 2-step RACH, the simpler solution is to have the TP. Probably to address QC’s concern, we may not need to mention the parameter of *cyclicPrefix* here? |
| Intel | We are fine with updated TP without mentioning *cyclicPrefix.* |
| vivo | The motivation to adopt ECP for 2-step RACH is not clear to us. If the majority is to include ECP for 2-step RACH, we are fine with the updated TP |
| Ericsson | Fine with the updated TP. |

# Resource overhead of MsgA PUSCH (issue #7.1)

R1-2006609 proposed to capture the same assumption of Msg3 resource overhead for MsgA. The resource overhead per PRB is assumed to be zero for Msg3, which should also be applied for MsgA PUSCH

***Proposal 3:***

* Adopt the TP#3 in 38.214, to capture the assumption of resource overhead for MsgA.

**Reasons for change**

To capture the same assumption of Msg3 resource overhead for MsgA

**Summary of changes**

Implement the above updates

**Specs/Sections impacted**

TS 38.214 Section 6.1.4.2

-------------------------**Text proposal #3 starts for TS 38.214** ----------------------------

#### 6.1.4.2 Transport block size determination

<Unchanged Text Omitted>

The UE shall first determine the number of REs (*NRE*) within the slot:

- A UE first determines the number of REs allocated for PUSCH within a PRB  by

- , where is the number of subcarriers in the frequency domain in a physical resource block,  is the number of symbols *L* of the PUSCH allocation according to Clause 6.1.2.1 for scheduled PUSCH or Clause 6.1.2.3 for configured PUSCH,  is the number of REs for DM-RS per PRB in the allocated duration including the overhead of the DM-RS CDM groups without data, as described for PUSCH with a configured grant in Clause 6.1.2.3 or as indicated by DCI format 0\_1 or DCI format 0\_2 or as described for DCI format 0\_0 in Clause 6.2.2, and  is the overhead configured by higher layer parameter *xOverhead* in*PUSCH-ServingCellConfig*. If the  is not configured (a value from 6, 12, or 18), the  is assumed to be 0. For Msg3 or MsgA PUSCH transmission the  is always set to 0. In case of PUSCH repetition Type B,  is determined assuming a nominal repetition with the duration of *L* symbols without segmentation.

<Unchanged Text Omitted>

------------------------- **Text proposal #3 ends for TS 38.214** -------------------------------

Any comments?

|  |  |
| --- | --- |
| Company | Comment |
| Nokia | OK for TP#3 |
| Intel | We are fine with the TP |
| Qualcomm | TP#3 looks good to us. |
| Ericsson | OK. |
| CATT | We are fine with TP#3 because PTRS/SRS transmission won’t be configured/executed when MsgA PUSCH transmission is implemented |
| Apple | We are ok with TP#3. |
| Spreadtrum | We are fine with the TP. |
| vivo | Support the TP. |

# Summary

Based on the first round discussions, the following TPs will be proposed for approval. And the potential CRs to 38.213 and 38.214 will be prepared accordingly…

***Proposal 2:***

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**Reasons for change**

To capture the default TDRA table 6.1.2.1.1-3 of extended CP for MsgA PUSCH

**Summary of changes**

Implement the above updates

**Specs/Sections impacted**

TS 38.213 Section 8.1A

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8.1A PUSCH for Type-2 random access procedure

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<Unchanged Text Omitted>

------------------------- **Text proposal #2 ends for TS 38.213** -------------------------------

***Proposal 3:***

* Adopt the TP#3 in 38.214, to capture the assumption of resource overhead for MsgA.

**Reasons for change**

To capture the same assumption of Msg3 resource overhead for MsgA

**Summary of changes**

Implement the above updates

**Specs/Sections impacted**

TS 38.214 Section 6.1.4.2

-------------------------**Text proposal #3 starts for TS 38.214** ----------------------------

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- , where is the number of subcarriers in the frequency domain in a physical resource block,  is the number of symbols *L* of the PUSCH allocation according to Clause 6.1.2.1 for scheduled PUSCH or Clause 6.1.2.3 for configured PUSCH,  is the number of REs for DM-RS per PRB in the allocated duration including the overhead of the DM-RS CDM groups without data, as described for PUSCH with a configured grant in Clause 6.1.2.3 or as indicated by DCI format 0\_1 or DCI format 0\_2 or as described for DCI format 0\_0 in Clause 6.2.2, and  is the overhead configured by higher layer parameter *xOverhead* in *PUSCH-ServingCellConfig*. If the  is not configured (a value from 6, 12, or 18), the  is assumed to be 0. For Msg3 or MsgA PUSCH transmission the  is always set to 0. In case of PUSCH repetition Type B,  is determined assuming a nominal repetition with the duration of *L* symbols without segmentation.

<Unchanged Text Omitted>

------------------------- **Text proposal #3 ends for TS 38.214** -------------------------------