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

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

**Source: Moderator (ZTE)**

**Title: Email Discussion Summary of [102-e-NR-7.1CRs-01]**

**Agenda item: 7.1**

**Document for:** **Discussion/Decision**

# Introduction

During RAN1#102-e, six contributions were submitted to discuss and clarify the potential ambiguity issue for Msg3 PUSCH retransmission power control [1-6]. During the preparation phase, companies agreed to discuss this issue in RAN1#102-e meeting.

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| -       [102-e-NR-7.1CRs-01] Determination of P0 for a Msg3 PUSCH retransmission by 8/24 – Bo (ZTE)    For Rel-15, Issue#1 in R1-2006958    Discussion/Agreements by 8/19, TPs by 8/24 |

This summary is trying to collect/summarize companies’ input and draw potential TP based on companies’ input.

# Discussion

## Background introduction

In LTE, Msg3 PUSCH first transmission and its retransmission have the same PO\_UE\_PUSCH. But in NR, there is no specific description for Msg3 PUSCH retransmission regarding PO\_UE\_PUSCH, as follows.

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| -  is a parameter composed of the sum of a component  and a component  where .  - If a UE is not provided *P0-PUSCH-AlphaSet* or for a PUSCH transmission scheduled by a RAR UL grant as described in Clause 8.3, , , and , where the parameter *preambleReceivedTargetPower* [11, TS 38.321] (for ) and *msg3-DeltaPreamble* (for ) are provided by higher layers, or  dB if *msg3-DeltaPreamble* is not provided, for carrier  of serving cell  - For a PUSCH (re)transmission configured by *ConfiguredGrantConfig*, ,  is provided by *p0-NominalWithoutGrant*, or  if *p0-NominalWithoutGrant* is not provided, and  is provided by *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a  value, applicable for all , is provided by *p0-NominalWithGrant,* or  if *p0-NominalWithGrant* is not provided, for each carrier  of serving cell  and a set of values are provided by a set of *p0* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided by *SRI-PUSCH-PowerControl* more than one values of *p0-PUSCH-AlphaSetId* and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the value of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCHPowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets*  - For  - For ,  is a value of *msg3-Alpha*, when provided; otherwise,  - For ,  is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a set of  values are provided by a set of *alpha* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided *SRI-PUSCH-PowerControl* and more than one values of *p0-PUSCH-AlphaSetId*, and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the values of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCH-PowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* |

According to the current NR specification, Msg3 PUSCH first transmission and its retransmission have the same PO\_UE\_PUSCH before RRC CONNECTED mode. However, if Msg3 PUSCH retransmission occurs in RRC CONNECTED mode, when there is a *P0-PUSCH-AlphaSet* configured, the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* should be considered for the Msg3 PUSCH retransmission. That means that Msg3 PUSCH retransmission may have different value from Msg3 PUSCH first transmission in RRC CONNECTED mode.

It seems no specific benefit to have different PO\_UE\_PUSCH values for Msg3 PUSCH retransmission and Msg3 PUSCH first transmission. If PO\_UE\_PUSCH value for Msg3 PUSCH retransmission is lower than for Msg3 PUSCH first transmission, it may impact the performance of Msg3 PUSCH retransmission. Furthermore, if the difference of two PO\_UE\_PUSCH values is large, it may break the power continuity for a plurality of Msg3 PUSCH transmissions and one TPC command may be not enough to compensate the gap.

## Companies’ input

According to the input from contributions [1-6], unifying PO\_UE\_PUSCH value for Msg3 PUSCH retransmission and Msg3 PUSCH first transmission is recommended. In technical, this is also aligned with the already UE implementation. The potential TP for Rel-15 is provided as follows. It is noted that the terminology of “Msg3 PUSCH retransmission” has been used in Section 8.3 PUSCH scheduled by RAR UL grant in TS 38.213.

***Candidate TP****: {38.213: 7.1.1 UE behaviour}*

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| 7.1.1 UE behaviour If a UE transmits a PUSCH on active UL BWP  of carrier  of serving cell  using parameter set configuration with index  and PUSCH power control adjustment state with index , the UE determines the PUSCH transmission power  in PUSCH transmission occasion  as  [dBm]  where,  - is the UE configured maximum output power defined in [8-1, TS 38.101-1], [8-2, TS38.101-2] and [8-3, TS38.101-3] for carrier  of serving cell  in PUSCH transmission occasion .  -  is a parameter composed of the sum of a component  and a component  where .  - If a UE is not provided *P0-PUSCH-AlphaSet* or for a PUSCH transmission scheduled by a RAR UL grant as described in Clause 8.3 or for a Msg3 PUSCH retransmission, , , and , where the parameter *preambleReceivedTargetPower* [11, TS 38.321] (for ) and *msg3-DeltaPreamble* (for ) are provided by higher layers, or  dB if *msg3-DeltaPreamble* is not provided, for carrier  of serving cell  - For a PUSCH (re)transmission configured by *ConfiguredGrantConfig*, ,  is provided by *p0-NominalWithoutGrant*, or  if *p0-NominalWithoutGrant* is not provided, and  is provided by *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a  value, applicable for all , is provided by *p0-NominalWithGrant,* or  if *p0-NominalWithGrant* is not provided, for each carrier  of serving cell  and a set of values are provided by a set of *p0* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided by *SRI-PUSCH-PowerControl* more than one values of *p0-PUSCH-AlphaSetId* and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the value of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission except for the Msg3 PUSCH retransmission is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCHPowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets*  - For  - For ,  is a value of *msg3-Alpha*, when provided; otherwise,  - For ,  is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a set of  values are provided by a set of *alpha* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided *SRI-PUSCH-PowerControl* and more than one values of *p0-PUSCH-AlphaSetId*, and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the values of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission except for the Msg3 PUSCH retransmission is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCH-PowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* |

Please provide company’s view in the table below.

* Note that the discussion for corresponding TP for Rel-16 will be made after this Rel-15 TP is stable.

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| Company | Comment |
| Samsung | We are supportive to make the change, however, we have identified only mentioned the msg.3 is not enough, since the issue exists for both msg.3 (in contention based RACH) and the PUSCH retransmission (in contention free RACH), that’s why in our proposed TP, we used the PUSCH (re-)transmission corresponding to the RAR UL grant, which is also the language used in LTE spec, we think it’s accurate enough.  Thus, we suggest for the TP, we should use “the PUSCH (re-)transmission corresponding to the RAR UL grant” to cover both CFRA and CBRA. |
| MediaTek | We also think the change is needed. Otherwise, the performance of PUSCH retransmission for RAR UL grant may be degraded.  We agree that the TP proposed by Samsung can cover both CBRA & CFRA. So, we are fine with Samsung’s proposal. |
| Huawei, HiSilicon | Samsung’s wording is better. Therefore, in order to get a full picture of compact changes, we suggest the changes,   * Change1: “If a UE is not provided *P0-PUSCH-AlphaSet* or for a PUSCH (re-)transmission corresponding to a RAR UL grant as described in Clause 8.3, ,” * Change2&3: “If the PUSCH transmission except for the PUSCH retransmission corresponding to a RAR UL grant is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field,” |
| Nokia/NSB | We support the change. We slightly prefer Huawei’s words. |
| Ericsson | We are fine with the change, and we prefer the wording suggested by HW. |
| OPPO | We support the change from Huawei. |
| vivo | We are fine with the change suggested by HW |
| Spreadtrum | We are fine with the wording from Huawei |
| CATT | We don’t think any change is needed. It is an implementation issue. P0 value is generally similar for UL PUSCH in the same type (e.g., eMBB, URLLC, initial access). The P0 value for CONNECTED mode UE is assigned by gNB. For RACH procedure in CONNECTED mode, gNB should ensure the P0 value of RAR retransmission is not deviated from the P0 value of initial transmission. |

# Summary

According to the companies’ input, all companies support that the same P0 value should be applied for both RAR transmission and RAR retransmission. Majority companies (8 companies) can support the TP with changes according to the recommendation from Samsung and Huawei, and one company prefers that the changes may not be needed and left for gNB implementation.

In our views, it is the CR phase of Rel-15, and backward compatibility should be fully considered. It may not be easy for asking gNB to handle this issue by implementation at this stage. Since all companies support the same P0 value applied for both RAR transmission and RAR retransmission, it seems that explicitly specifying the same P0 for both RAR transmission and RAR retransmission is NOT against the basic intention for the product implementation for all companies.

Then, we have the following potential TP is updated based on the Huawei’s suggestion.

***Draft TP****: {38.213: 7.1.1 UE behaviour}*

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| 7.1.1 UE behaviour If a UE transmits a PUSCH on active UL BWP  of carrier  of serving cell  using parameter set configuration with index  and PUSCH power control adjustment state with index , the UE determines the PUSCH transmission power  in PUSCH transmission occasion  as  [dBm]  where,  - is the UE configured maximum output power defined in [8-1, TS 38.101-1], [8-2, TS38.101-2] and [8-3, TS38.101-3] for carrier  of serving cell  in PUSCH transmission occasion .  -  is a parameter composed of the sum of a component  and a component  where .  - If a UE is not provided *P0-PUSCH-AlphaSet* or for a PUSCH (re)transmission corresponding to a RAR UL grant as described in Clause 8.3, , , and , where the parameter *preambleReceivedTargetPower* [11, TS 38.321] (for ) and *msg3-DeltaPreamble* (for ) are provided by higher layers, or  dB if *msg3-DeltaPreamble* is not provided, for carrier  of serving cell  - For a PUSCH (re)transmission configured by *ConfiguredGrantConfig*, ,  is provided by *p0-NominalWithoutGrant*, or  if *p0-NominalWithoutGrant* is not provided, and  is provided by *p0* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that provides an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a  value, applicable for all , is provided by *p0-NominalWithGrant,* or  if *p0-NominalWithGrant* is not provided, for each carrier  of serving cell  and a set of values are provided by a set of *p0* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided by *SRI-PUSCH-PowerControl* more than one values of *p0-PUSCH-AlphaSetId* and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the value of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission except for the PUSCH retransmission corresponding to a RAR UL grant is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCHPowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets*  - For  - For ,  is a value of *msg3-Alpha*, when provided; otherwise,  - For ,  is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet* for active UL BWP  of carrier  of serving cell  - For , a set of  values are provided by a set of *alpha* in *P0-PUSCH-AlphaSet* indicated by a respective set of *p0-PUSCH-AlphaSetId* for active UL BWP  of carrier  of serving cell  - If the UE is provided *SRI-PUSCH-PowerControl* and more than one values of *p0-PUSCH-AlphaSetId*, and if DCI format 0\_1 includes a SRI field, the UE obtains a mapping from *sri-PUSCH-PowerControlId* in *SRI-PUSCH-PowerControl* between a set of values for the SRI field in DCI format 0\_1 [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values. If the PUSCH transmission is scheduled by a DCI format 0\_1 that includes a SRI field, the UE determines the values of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value  - If the PUSCH transmission except for the PUSCH retransmission corresponding to a RAR UL grant is scheduled by a DCI format 0\_0 or by a DCI format 0\_1 that does not include a SRI field, or if *SRI-PUSCH-PowerControl* is not provided to the UE, , and the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* |

# Reference

[1] R1-2005446, Discussion on determining P0 for a Msg3 PUSCH retransmission, ZTE

[2] R1-2005447, Draft CR on determining P0 for a Msg3 PUSCH retransmission in TS 38.213, ZTE

[3] R1-2005630, Draft CR on correction for Msg3 PUSCH retransmission power control, MediaTek Inc.

[4] R1-2006085, 38.213 DRAFT CR (Rel-15, F) on msg3 power determination, Samsung

[5] R1-2006086, 38.213 DRAFT CR (Rel-16, A) on msg3 power determination, Samsung

[6] R1-2006087, Discussion on msg3 power determination, Samsung