**3GPP TSG-RAN WG1 Meeting #104b-e R1-210xxxx**

**e-Meeting, April 12th – 20th, 2021**

**Agenda Item: 7.2.1**

**Source: Moderator (ZTE)**

**Title: Summary of email discussion for [104-e-NR-2Step-RACH-01]**

**Document for: Discussion**

# Introduction

This document is intended to address the following corrections for 2-step RACH by email discussion.

[104b-e-NR-2Step-RACH-01] Email discussion/approval of the corrections of 2-step RACH related issues till 4/15 (Li, ZTE)

* CR in R1-2103403, CR in R1-2103495 and two TPs in R1-2103680

# Correction on the configuration of RACH-related power control parameters

In R1-2103403, it is mentioned that when both 2-step RACH and 4-step RACH are configured, and is equal to , there could be possible misunderstanding that *msgA-Alpha* will be used for both 2-step RACH and 4-step RACH, which is inconsistent with the agreement.

***Proposal 1:***

* Adopt the following TP#1 in 38.213, to avoid the ambiguity on the conditions for the configuration of power control parameters.

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| **Reasons for change**  The *msgA-Alpha* and *msg3-Alpha* should be used for the PUSCH transmission of 2-step RACH and 4-step RACH, respectively. However, according to current TS 38.213, when both 2-step RACH and 4-step RACH are configured, and is equal to , *msgA-Alpha* will be used for both 2-step RACH and 4-step RACH.  **Summary of changes**  Change the conditions for the configuration of power control parameters *msgA-Alpha* and *msg3-Alpha.* **Consequences if not approved:**  Use the wrong power control parameter for PUSCH transmission during RACH procedure  **Specs/Sections impacted**  TS 38.213, Section 7.1.1  ------------------------- **Start of Text Proposal #1 for TS 38.213** ---------------------------- 7 Uplink Power control7.1 Physical uplink shared channel7.1.1 UE behaviour \*\*\* Unchanged text is omitted \*\*\*  - For  - For ,  - if is determined by and , and *msgA-Alpha* is provided, is the value of *msgA-Alpha*  - elseif  - is determined by and , or *msgA-Alpha* is not provided, and  - *msg3-Alpha* is provided,  -  is the value of *msg3-Alpha*  - else,  \*\*\* Unchanged text is omitted \*\*\*  ------------------------- **End of Text Proposal #1**------------------------------- |

## Comments to proposal 1

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| Company | Comments |
| Samsung  (prep phase) | In the early part of section 7.1.1, there is already conditions for setting , and the change of order of *msg3-alpha* did not change the behavior comparing with old version. The “elseif” part was saying when *msgA-alpha* is not configured, and *msg3-alpha*, we will use *msg3-alpha*. It seems no difference comparing what we have now. |
| Huawei  (prep phase) | A quick response to Samsung: the interpretation of “=” in the equation of concerned texts may be misleading, in the sense that “=” only cares about the final results so that when the two delta values are the same then there could be the case that the “if” and “elseif” condition does not differentiate. So the intention is just to make it clear that the behavior is to check how is determined by, rather than what value is. |
| Ericsson | Agree with the intention of the CR.  However, to make it clear, it seems we do not even need to mention to determine which alpha is used. Thus, we propose to use following TP, TP#1-a instead:  ------------------------- **Start of Text Proposal #1-a** -------------------------------  \*\*\* Unchanged text is omitted \*\*\*  - For  - For ,  - if a Type-2 random access procedure is used, as described in Clause 8, ~~if~~ and *msgA-Alpha* is provided, is the value of *msgA-Alpha*  - elseif a Type-1 random access procedure is used, as described in Clause 8, ~~or~~ *~~msgA-Alpha~~* ~~is not provided,~~ and *msg3-Alpha* is provided,  is the value of *msg3-Alpha*  - else,  \*\*\* Unchanged text is omitted \*\*\*  ----------------------------- **End of Text Proposal #1-a** ------------------------------- |
| ZTE | We understand the intention of the TP, but it seems hard to have misunderstanding for UE implementation.  If the majority think it is a critical issue, we slightly prefer Ericsson’s version than the original TP because it may cause further ambiguity to UE implementation on how to understand the wording of “determined by”. |
| Qualcomm | We prefer the following TP for clarity:  ------------------------- **Start of Text Proposal #1-b** -------------------------------  \*\*\* Unchanged text is omitted \*\*\*  - For  - For ,  - if a Type-2 random access procedure is used, ~~if~~ and *msgA-Alpha* is provided: is the value of *msgA-Alpha, and*  is determined by and ;  - elseif a Type-1 random access procedure is used  ~~or~~ *~~msgA-Alpha~~* ~~is not provided,~~ and *msg3-Alpha* is provided:  is the value of *msg3-Alpha, and*  is determined by and  - else,  \*\*\* Unchanged text is omitted \*\*\*  ----------------------------- **End of Text Proposal #1-b**-------------------------------  We are also ok with TP #1a proposed by Ericsson |
| CATT | In our understanding, the description in current TS 38.213 (g50) is clear and proposed TP is unnecessary. |
| Apple | According to our understanding, the current spec is clear. It seems the CR is not essential correction and not needed. |
| Samsung | We understand the intention of the CR, however, it’s really not practical that such ambiguity could happen based on the mathematical value being “accidently” same. So we prefer current version without change.  Besides, the suggested change by CR is not proper as explained by ZTE; the suggested change from E/// or QC are also not proper because the conditions on using Type-1 or Type-2 RA is not exactly same as the original equation, i.e., UE uses Type 2-RA but goes to fallbackRAR, original it should use *msg3-Alpha*, then by the suggested change, UE should use *msgA-Alpha.* |

# Editorial corrections on the DMRS description for MsgA

R1-2103495 identified a few editorial issues on the DMRS description for MsgA, copied as follows.

***Proposal 2:***

* Adopt the following TP#2 in 38.211, to correct the editorial issues of the DMRS description of MsgA.

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| **Reasons for change**  Some typos and copy-paste errors were found in the latest specification.  **Summary of changes**  Editorial corrections for the description of DMRS configurations for MsgA.  **Consequences if not approved:**  Cause ambiguity in understanding.  **Specs/Sections impacted**  TS 38.211, Section 6.4.1.1.3  -----------------------**Start of Text Proposal #2 for TS 38.211** ---------------------------- 6.4.1.1.3 Precoding and mapping to physical resources < Unchanged parts are omitted >  For PUSCH mapping type A,  - the case *dmrs-AdditionalPosition* equals to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2';  - symbols in Table 6.4.1.1.3-4 is only applicable when *dmrs-TypeA-Position* is equal to 'pos2'.  For msgA transmitted using PUSCH mapping type A,  - the case *msgA-DMRS-AdditionalPosition* equals to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2';  - *'dmrs-AdditionalPosition*' in Tables ~~Tables~~ 6.4.1.1.3-3 to 6.4.1.1.3-6 shall be replaced by *msgA-DMRS-AdditionalPosition;*  - only PUSCH DM-RS configuration type 1 is supported.  For msgA transmitted using PUSCH mapping type B,  - '*dmrs-AdditionalPosition*' in Tables 6.4.1.1.3-3 to 6.4.1.1.3-6 shall be replaced by *msgA-DMRS-AdditionalPosition*;  - only PUSCH DM-RS configuration type 1 is supported.  < Unchanged parts are omitted >  -------------------------**End of Text proposal #2** ---------------------------- |

## Comments to proposal 2

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| Company | Comment |
| Ericsson | Agree with the 3rd update to remove the 2nd “tables”. However, the first and 2nd updates are not necessary since “equal” can be an adjective here. |
| ZTE | Respond to Ericsson:  The first and 2nd updates are consistent with the description of DL in the spec, e.g.  In section 7.4.1.1.2  For PDSCH mapping type A  - the case *dmrs-AdditionalPosition* equals to 'pos3' is only supported when *dmrs-TypeA-Position* is equal to 'pos2'; |
| Qualcomm | OK with TP#2 |
| CATT | We are fine with FL proposal. |
| Apple | We are ok with FL proposal. |
| Samsung | Seems fine. |

# Determination of power control parameter in case of 2-step RACH only operation

In R1-2103680, it was mentioned that in NR release 15 and 16, one or multiple sets of p0 and alpha values may or may not be configured for PUSCH power control. When it is not configured, the alpha and P0-nomilal for msg3 are supposed to be used for the power calculation of a nomal PUSCH according to the definition of *p0-AlphaSets* in RRC specification below.

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| ***p0-AlphaSets***  configuration {p0-pusch, alpha} sets for PUSCH (except msg3), i.e., {{p0,alpha,index1}, {p0,alpha,index2},...} (see TS 38.213 [13], clause 7.1). When no set is configured, the UE uses the P0-nominal for msg3 PUSCH, P0-UE is set to 0 and alpha is set according to msg3-Alpha configured for msg3 PUSCH. |

However, msg3 will be not supported when only 2-step RACH is configured, i.e. when 4-step RACH is not configured. In this case, it is not clear which alpha or nominal p0 configuration should be used for a normal PUSCH transmission.

To solve this issue, when *p0-AlphaSets* is not provided in case of 2-step RACH only operation, for power control of a normal PUSCH other than MsgA PUSCH or Msg3 PUSCH, *P0-nominal* and *alpha* for msgA PUSCH are used.

***Proposal 3:***

* In case of 2-step RACH only operation, when *p0*-*AlphaSets* is not provided, for power control of normal PUSCH, *P0-nominal* and *alpha* for msgA PUSCH are used, according to TP#3.

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| Reason for change:  Msg3 will be not supported when only 2-step RACH is configured, i.e. when 4-step RACH is not configured. In this case, it is not clear which alpha or nominal p0 configuration should be used for a normal PUSCH transmission when *p0-AlphaSets* is not provided.  Summary of change:  In case of 2-step RACH only operation, when *p0*-*AlphaSets* is not provided, for power control of normal PUSCH, *P0-nominal* and *alpha* for msgA PUSCH are used.  Consequences if not approved:  It is not clear which alpha or nominal p0 configuration should be used for a normal PUSCH transmission  Clauses affected:  TS38.213, Section 7.1.1  -----------------------**Start of Text Proposal #3 for TS 38.213** ----------------------------  7.1.1 UE behaviour  \*\*\* unchanged text omitted\*\*\*  -  is a parameter composed of the sum of a component  and a component  where .  - If a UE established dedicated RRC connection using a Type-1 random access procedure, as described in Clause 8, and 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 is provided by *preambleReceivedTargetPower* [11, TS 38.321] and is provided by *msg3-DeltaPreamble*, or  dB if *msg3-DeltaPreamble* is not provided, for carrier  of serving cell  - If a UE established dedicated RRC connection using a Type-2 random access procedure, as described in Clause 8, and is not provided *P0-PUSCH-AlphaSet*,or for a PUSCH transmission for Type-2 random access procedure as described in Clause 8.1A,  , , and ,  where is provided by *msgA-preambleReceivedTargetPower*, or by *preambleReceivedTargetPower* if *msgA-preambleReceivedTargetPower* isnot provided and is provided by *msgA-DeltaPreamble*, or dB if *msgA-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 a DCI format scheduling the PUSCH transmission includes an 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 the DCI format [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values and determines the value of  from the *p0-PUSCH-AlphaSetId* value that is mapped to the SRI field value. If the DCI format also includes an open-loop power control parameter set indication field and a value of the open-loop power control parameter set indication field is '1', the UE determines a value of  from a first value in *P0-PUSCH-Set* with a *p0-PUSCH-SetId* value 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 that does not include an SRI field, or if *SRI-PUSCH-PowerControl* is not provided to the UE, ,  - If *P0-PUSCH-Set* is provided to the UE and the DCI format includes an open-loop power control parameter set indication field, the UE determines a value of  from  - a first *P0-PUSCH-AlphaSet* in *p0-AlphaSets* if a value of the open-loop power control parameter set indication field is '0' or '00'  - a first value in *P0-PUSCH-Set* with the lowest *p0-PUSCH-SetID* value if a value of the open-loop power control parameter set indication field is '1' or '01'  - a second value in *P0-PUSCH-Set* with the lowest *p0-PUSCH-SetID* value if a value of the open-loop power control parameter set indication field is '10'  - else, the UE determines  from the value of the first *P0-PUSCH-AlphaSet* in *p0-AlphaSets*  - For  - For ,  - if and *msgA-Alpha* is provided, is the value of *msgA-Alpha*  - elseif or *msgA-Alpha* is not provided, and *msg3-Alpha* is provided,  is the value of *msg3-Alpha*  - else,  - 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 a DCI format scheduling the PUSCH transmission includes an 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 the DCI format [5, TS 38.212] and a set of indexes provided by *p0-PUSCH-AlphaSetId* that map to a set of *P0-PUSCH-AlphaSet* values and 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 that does not include an 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*  - For or if *P0-PUSCH-AlphaSet* is not configured, the UE uses the *P0-nominal* and *msg3-Alpha* configured for msg3 PUSCH if a Type-1 random access is configured for the BWP or uses the *P0-nominal* and *msgA-Alpha* for msgA PUSCH if a Type-1 random access procedure is not configured for the BWP.  \*\*\* unchanged text omitted\*\*\*  -----------------------**End of Text Proposal #3** ---------------------------- |

## Comments to proposal 3

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| Company | Comment |
| Ericsson | Agree and one minor comment on the text for the cover page is provided above. |
| ZTE | The TP introduce a new behavior which is not supported by the previous agreement. To our understanding, the current specification can work without the TP or without considering the 2-step RACH configuration, i.e. if 4-step RACH is not configured and 2-step RACH is configured for a BWP, the behavior should be the same as that both 4-step RACH and 2-step RACH are not configured for a BWP. |
| Qualcomm | Agree with the TP in principle. Prefer a better wording of the TP for clarity.  The conditions that UE uses P0-nominal and msg3-Alpha configured for msg3 PUSCH should include:   * Type-1 random access is configured for the BWP * Type-1 random access procedure is selected by UE   Similarly, the conditions that UE uses the P0-nominal and msgA-Alpha for msgA PUSCH should be:   * Type-2 random access is configured for the BWP   Type-2 random access procedure is selected by UE |
| CATT | We have the same view with ZTE. If 2-step RACH is only configured for a BWP, UE behavior should be the same as that both 4-step RACH and 2-step RACH are not configured for a BWP. |
| Apple | In general, we are ok with this proposal. For updates on 4-step RACH part, it maybe not needed which is covered by 38.331. Otherwise, a Rel.15 CR maybe needed as well.  For the 2-step RACH only case, according to our understanding, this case was already supported by RAN2 spec, 2-step RACH can work standalone. |
| Samsung | As similar view as ZTE and our comments in proposal 4,  In conventional operation without 2step RACH, there could be the case that a BWP has no 4step RACH, so this issue is regardless of 2step RACH, so an UE behavior has already been implemented, UE just follows that same behavior is fine. We did not need to additionally introduce new function/behavior for power control parameter determination due to 2step RACH. |

# Determination of PUSCH waveform in case of 2-step RACH only operation

In R1-2103680, it was also mentioned that the transform precoder is enabled or disabled based on the *transformPrecoder* configured in *ConfiguredGrantConfig* for CG based PUSCH transmission or based on the *transformPrecoder* configured in *pusch-Config* for DG based PUSCH transmission. When the parameter *transformPrecoder* is not configured, the configuration for msg3 is used.

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| ***transformPrecoder***  The UE specific selection of transformer precoder for PUSCH (see TS 38.214 [19], clause 6.1.3). When the field is absent the UE applies the value of the field *msg3-transformPrecoder*. |

However in 2-step RACH only operation, there will be no msg3 configuration, and if the *transformPrecoder* field is absent in the CG PUSCH configuration, the waveform of the CG based PUSCH is not known. This will also make it not clear on how to determine the DRMS sequence since different types of DMRS sequences are supported for different waveforms in NR. Furthermore, the MCS table to be used will be not clear either since for different waveforms different MCS tables are defined for PUSCH transmission in NR.

To make it clear on which waveform to use when the Msg3 is not supported, one simply way is that transform precoding is always enabled or disabled, another way is that *msgA-TransformPrecoder* is to be used when only 2-step RACH is configured. In our view, the latter is preferred instead of forcing UE to always use CP-OFDM or DFT-s-OFDM in such case. A corresponding text proposal TP2 to 38.214 can be used to correct this.

***Proposal 4:***

* In case of 2-step RACH only operation, when *transformPrecoder* is not provided, waveform of normal PUSCH is determined based on *msgA-transformPrecoder* according to TP#4.

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| **Reasons for change**  Msg3 will be not supported when only 2-step RACH is configured, i.e. when 4-step RACH is not configured. In this case, it is not clear which waveform should be used for a normal PUSCH transmission when dedicated signaling is not available.  **Summary of changes**  In case of 2-step RACH only operation, when *transformPrecoder* is not provided, waveform of normal PUSCH is determined based on the waveform of MsgA PUSCH..  **Consequences if not approved:**  Waveform of normal PUSCH is not clear in the case of 2-step RACH only operation and when *transformPrecoder* is not provided..  **Specs/Sections impacted**  TS 38.214, Section 6.1.3  -----------------------**Start of Text Proposal #4 for TS 38.214** ----------------------------  6.1.3 UE procedure for applying transform precoding on PUSCH  \*\*\* unchanged text omitted\*\*\*  For PUSCH transmission scheduled by a PDCCH with CRC scrambled by CS-RNTI with NDI=1, C-RNTI, or MCS-C-RNTI or SP-CSI-RNTI:  - If the DCI with the scheduling grant was received with DCI format 0\_0, the UE shall, for this PUSCH transmission, consider the transform precoding either enabled or disabled according to the higher layer configured parameter *msg3-transformPrecoder* if a Type-1 random access is configured for the BWP or *msgA-transformPrecoder* if a Type-1 random access is not configured for the BWP.  - If the DCI with the scheduling grant was not received with DCI format 0\_0  - If the UE is configured with the higher layer parameter *transformPrecoder* in *pusch-Config*, the UE shall, for this PUSCH transmission, consider the transform precoding either enabled or disabled according to this parameter.  - If the UE is not configured with the higher layer parameter *transformPrecoder* in *pusch-Config*, the UE shall, for this PUSCH transmission, consider the transform precoding either enabled or disabled according to the higher layer configured parameter *msg3-transformPrecoder* if a Type-1 random access is configured for the BWP or *msgA-transformPrecoder* if a Type-1 random access is not configured for the BWP.  For PUSCH transmission with a configured grant  - If the UE is configured with the higher layer parameter *transformPrecoder* in *configuredGrantConfig*, the UE shall, for this PUSCH transmission, consider the transform precoding either enabled or disabled according to this parameter.  - If the UE is not configured with the higher layer parameter *transformPrecoder* in *configuredGrantConfig*, the UE shall, for this PUSCH transmission, consider the transform precoding either enabled or disabled according to the higher layer configured parameter *msg3-transformPrecoder* if a Type-1 random access is configured for the BWP or *msgA-transformPrecoder* if a Type-1 random access is not configured for the BWP.  \*\*\* unchanged text omitted\*\*\*  -------------------------**End of Text proposal #4** ---------------------------- |

## Comments to proposal 4

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| Company | Comment |
| Ericsson | Agree and some text for cover page are proposed to be updated according to our comments above as well. |
| ZTE | Same comment as proposal 3.  The TP introduce a new behavior which is not supported by the previous agreement. To our understanding, the current specification can work without the TP or without considering the 2-step RACH configuration, i.e. if 4-step RACH is not configured and 2-step RACH is configured for a BWP, the behavior should be the same as that both 4-step RACH and 2-step RACH are not configured for a BWP. |
| Qualcomm | Not sure “a Type-1 random access is not configured” is equivalent to “only a Type-2 random access is configured.” Prefer a clarification of the conditions as we commented in proposal 3. |
| CATT | We have the same view with ZTE. |
| Apple | The *msgA-transformPrecoder* is not mandatory configured. If it’s not configured, the UE disables the transformer precoder. |
| Samsung | As we commented in preparation phase and similar view as ZTE,  In conventional operation without 2step RACH, there could be the case that a BWP has no 4step RACH, so this issue is regardless of 2step RACH, so an UE behavior has already been implemented, UE just follows that same behavior is fine. We did not need to additionally introduce new function/behavior for CG PUSCH waveform determination due to 2step RACH. |

# Summary

The final proposals and the potential CRs are to be updated…

# References

1. R1-2103403 Correction on the configuration of RACH-related power control parameters Huawei, HiSilicon
2. R1-2103495 Editorial corrections on the DMRS description for MsgA ZTE, Sanechips
3. R1-2103680 Discussion on corrections for 2-step RACH Ericsson