**3GPP TSG RAN WG1 Meeting #119 R1-240xxxx**

**Orlando, USA, November 18– 22, 2024**

**Agenda Item: 7**

**Source: Moderator (Huawei)**

**Title: Summary#1 of discussion on power control for 2-step RACH**

**Document for: Discussion and Decision**

# Introduction

In [2], two issues related to parameter p0-nominal are identified when 2-step RACH is configured by gNB. To fix these issues, two alterative draft CRs are proposed in [1].

This document is a summary of discussions for these issues.

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| **TS 38.213 v16.17.0**7.1.1 UE behaviourIf 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, TS 38.101-2] and [8-3, TS 38.101-3] 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 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  |

According to the text highlighted in cyan above, a UE needs to apply to determine the transmit power of CG PUSCH/DG PUSCH in some cases e.g. *P0-PUSCH-AlphaSet* is not configured or *p0-NominalWithoutGrant*/*p0-NominalWithGrant* is not configured.

According to the text highlighted in yellow above, when 2-step RACH is configured in SIB1, there are two values , i.e. for 4-step RACH while for 2-step RACH .

**Issue 1**

According to S7.1.1 of TS 38.213, the open-loop power control of DG or CG PUSCH relies on the value of if *p0-NominalWithGrant/p0-NominalWithoutGrant* is not configured in a cell but 2-step RACH resources are configured. For EN-DC, the UE established dedicated RRC connection by LTE RACH which does not belong to NR type 1 or type 2 RACH. In this case, it is unclear how to determine for a NR PSCell with the highlight texts above, e.g. “If a UE established dedicated RRC connection using a Type-1 random access procedure”. As a result, there is no to be applied for CG/DG PUSCH if *P0-PUSCH-AlphaSet* is not configured in the Cell e.g. NR PSCell.

1. ***In the current specification, it is unclear how to determine***  ***for a cell of SCG in EN-DC case. As a result, if parameter P0-PUSCH-AlphaSet is not configured in the cell, it is unclear how to determine for CG/DG PUSCH which is equal to in this case.***

**Issue 2:**

For a PCell configured without CA/DC but with 2-step RACH feature, a similar issue as above occurs if *P0-PUSCH-AlphaSet*, *p0-NominalWithoutGrant or p0-NominalWithGrant* is not configured.

As shown in Figure 1 as an example, a UE may trigger 2-step RACH procedure first for e.g. RRC connection setup, and later use 4-step RACH for multiple procedures, including RRC reconfiguration, procedures of SR failure or UL data arrival during RRC\_CONNECTED mode when there are no PUCCH resources for SR available. It is not clear whether the for 4-step RACH or the for 2-step RACH should be used for CG/DG PUSCH.

For the transmit power of the 1st CG/DG PUSCH shown in Figure 1 below, for 2-step RACH (i.e. msgA PUSCH ) should be used to determine its transmit power, because the UE has not performed 4-step RACH yet and it does not make sense to use for 4-step RACH (i.e. msg3 PUSCH ) in this case.

However, for the transmit power of the 2nd CG/DG PUSCH shown in Figure 1 below, it is not clear whether to reuse the same as the previous 1st CG/DG PUSCH (i.e. msgA PUSCH ), or to use the new (i.e. msg3 PUSCH ).



Figure 1 one example for determination for CG/DG PUSCH if *P0-PUSCH-AlphaSet* is not configured or *p0-NominalWithoutGrant*/*p0-NominalWithGrant* is not configured

In summary, when 2-step RACH is configured and of 2-step RACH is different from of 4-step RACH, may be updated from 2-step RACH to 4-step RACH or vice versa. Once the is updated, it is not clear whether CG/DG PUSCH use the old or the new .

1. ***if p0-NominalWithoutGrant/p0-NominalWithGrant is not configured, once the is updated from 2-step RACH to 4-step RACH or vice versa, it is not clear which one (previous one or the updated one) should be used for CG/DG PUSCH.***

To address these two issues, two alternative solutions can be,

1. ***For a cell configured with 2-step RACH feature, adopt one of the following options:***
* ***Option 1: the most recent is used for CG/DG PUSCH if P0-PUSCH-AlphaSet is not configured or p0-NominalWithoutGrant/p0-NominalWithGrant is not configured.***
* ***Option 2: When UE dedicated RRC configuration is provided to a UE for the cell, all the three parameters P0-PUSCH-AlphaSet, p0-NominalWithoutGrant and p0-NominalWithGrant are expected to be configured.***
1. ***For a cell configured with 2-step RACH feature, adopt either one of CRs in [1].***

# Discussions

## Question 0: Please consider entering contact info below for the convenience of email contact and F2F discussions.

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| **Company** | **Point(s) of contact** | **Email address(es)** |
| Huawei, HiSilicon | Frank Yi LONG | frank.longyi@huawei.com |
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## Question 1-1: Do you agree with the observation#1 above? If not, considering that a UE has been in dedicated RRC connection before adding NR PSCell, what is your interpretation to “established dedicated RRC connection” in case of EN-DC with respect to the determination of ?

Companies’ views are welcome.

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## Question 1-2: With the example in figure 1, do you agree with the observation#2 above? If not, please elaborate your understanding to the texts highlighted in cyan below, i.e. which is applied here.

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| TS 38.213- 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  |

Companies’ views are welcome.

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## Question 1-3: If either observation#1 or #2 is correct, then for 2-step RACH, which solution is preferred? Any other solution is welcome.

1. ***For a cell configured with 2-step RACH feature, adopt one of the following options:***
* ***Option 1: the most recent is used for CG/DG PUSCH if P0-PUSCH-AlphaSet is not configured or p0-NominalWithoutGrant/p0-NominalWithGrant is not configured.***
* ***Option 2: When UE dedicated RRC configuration is provided to a UE for the cell, all the three parameters P0-PUSCH-AlphaSet, p0-NominalWithoutGrant and p0-NominalWithGrant are expected to be configured.***

Companies’ views are welcome.

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## Question 1-4: If either observation#1 or #2 is correct, then for 2-step RACH, any further comment to the two draft CRs in [1], as copied in Appendix?

Companies’ views are welcome.

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# 2nd round of discussions:

*[To be updated]*

Companies’ views are welcome.

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# Conclusions

For XXX online session,

***[TBD]***

# References

1. R1-2410607, “Draft CR for p0-nominal”, Huawei, HiSilicon, November 18-22, 2024.
2. R1-2410606, “Discussion on p0-nominal”, Huawei, HiSilicon, November 18-22, 2024.

# Appendix

The draft CR for Option 1 in [1]

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| < Unchanged parts are omitted >7.1.1 UE behaviourIf 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, TS 38.101-2] and [8-3, TS 38.101-3] for carrier  of serving cell  in PUSCH transmission occasion .-  is a parameter composed of the sum of a component  and a component  where . - If the most recent random access procedure is 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 the most recent random access procedure is 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 where if Type-2 random access procedure can be applied for the carrier  of serving cell , then the is determined according to the most recent PUSCH transmission corresponding to a RAR UL grant or msgA PUSCH, 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 where if Type-2 random access procedure can be applied for the carrier  of serving cell , then the is determined according to the most recent PUSCH transmission corresponding to a RAR UL grant or msgA PUSCH, 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*< Unchanged parts are omitted > |

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| < Unchanged parts are omitted >7.1.1 UE behaviourIf 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, TS 38.101-2] and [8-3, TS 38.101-3] for carrier  of serving cell  in PUSCH transmission occasion .-  is a parameter composed of the sum of a component  and a component  where . - If Type-2 random access procedure is available for the carrier  of serving cell , if UE dedicated RRC configuration is provided for the carrier, all three parameters *P0-PUSCH-AlphaSet*, *p0-NominalWithoutGrant* and *p0-NominalWithGrant* are expected to be configured for the carrier.- 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*< Unchanged parts are omitted > |