**3GPP TSG RAN WG1 #118 R1-2407448**

**Maastricht, Netherlands, August 19th– 23rd, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.213** | **CR** | **0662** | **rev** | **-** | **Current version:** | **18.3.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Correction on power control parameters for the UL transmission after LTM cell switch  |
|  |  |
| ***Source to WG:*** | Moderator (Fujitsu), Huawei, HiSilicon, ZTE, Sanechips, Ericsson, Nokia, Lenovo, Apple |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_Mob\_enh2-Core |  | ***Date:*** | 2024-08-20 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | In RAN2#126, it was agreed to introduce power control parameters P0 and alpha in the LTM TCI state. These parameters are used for UE to determine the UL transmission power after cell switch and before serving cell TCI state is indicated. However, such procedure is not reflected in RAN1 specifications. In addition, the case is not considered when serving cell TCI of target cell is not preconfigured before cell switch. |
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| ***Summary of change:*** | Add the description of procedure to use power control parameters for the UL transmission associated with LTM TCI state indicated in the cell switch command. |
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| ***Consequences if not approved:*** | The power control procedure for DG/CG-PUSCH after cell switch is not complete. |
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| ***Clauses affected:*** | 7, 7.1.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | **Isolated Impact Analysis:**This CR has no isolated impact on network and UE behavior. |
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| ***This CR's revision history:*** | This is the first version of this CR  |

# 7 Uplink Power control

Uplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions.

A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by *SRS-PosResourceSet* as described in clause 7.3.1. If the UE is provided a number of RS resources for pathloss estimation for PUSCH/PUCCH/SRS transmissions that is larger than 4, the UE maintains for pathloss estimation RS resources corresponding to RS resource indexes $q\_{d}$ as described in clauses 7.1.1, 7.2.1, and 7.3.1. If an RS resource updated by MAC CE, as described in clauses 7.1.1, 7.2.1 and 7.3.1, is one from the RS resources the UE maintains for pathloss estimation for PUSCH/PUCCH/SRS transmissions, the UE applies the pathloss estimation based on the RS resources starting from the first slot that is after slot $k+3∙N\_{slot}^{subframe, μ}+2^{μ}∙k\_{mac}$ where $k$ is the slot where the UE would transmit a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, $μ $is the SCS configuration for the PUCCH or PUSCH, respectively, that is determined in the slot when the MAC CE command is applied and $k\_{mac}$ is a number of slots for SCS configuration $μ=0$ provided by *kmac* or $k\_{mac}=0$ if *kmac* is not provided*.*

A PUSCH/PUCCH/SRS/PRACH transmission occasion $i$ is defined by a slot index $n\_{s,f}^{μ}$ within a frame with system frame number $SFN$, a first symbol $S$ within the slot, and a number of consecutive symbols $L$. For a PUSCH transmission with repetition Type B, a PUSCH transmission occasion is a nominal repetition [6, TS 38.214].

In the remaining of this clause, if a UE is provided *TCI-State* in *dl-OrJointTCI-StateList* or *TCI-UL-State* or *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CE*,* and for each indicated one or two *TCI-State* or *TCI-UL-State* or *CandidateTCI-State* or *CandidateTCI-UL-State* of a PUSCH, PUCCH, or SRS transmission occasion as described in [6, TS 38.214]

- in clauses 7.1.1, 7.2.1, and 7.3.1, the RS index $q\_{d}$ for obtaining the downlink pathloss estimate for PUSCH, PUCCH, and SRS transmission is provided by pathlossReferenceRS-Id-r17 associated with or included in the indicated *TCI-State* or *TCI-UL-State* except for SRS transmission that is not provided *followUnifiedTCI-StateSRS,* or by *pathlossReferenceRS-Id* included in *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CE

- in clause 7.1.1, if *p0AlphaSetforPUSCH* is provided, the values of $P\_{O\\_UE\\_PUSCH,b,f,c}\left(j\right)$, $α\_{b,f,c}\left(j\right)$, and the PUSCH power control adjustment state $l$ are provided by *p0AlphaSetforPUSCH* associated with the indicated *TCI-State* or *TCI-UL-State*, or by *p0AlphaSetforPUSCH* associated with the *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CE

- in clause 7.2.1, if *p0AlphaSetforPUCCH* is provided, the values of $P\_{O\\_UE\\_PUCCH}\left(q\_{u}\right)$ and the PUCCH power control adjustment state $l$ are provided by *p0AlphaSetforPUCCH* associated with the indicated *TCI-State* or *TCI-UL-State*, or by *p0AlphaSetforPUCCH* associated with the *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CE

- in clause 7.3.1, if *p0AlphaSetforSRS* is provided,

- if *followUnifiedTCI-StateSRS* is provided for a SRS resource set, the values of $P\_{O\\_UE\\_SRS,b,f,c}\left(q\_{s}\right)$, $α\_{SRS,b,f,c}\left(q\_{s}\right)$, and SRS power control adjustment state $l$ are provided by *p0AlphaSetforSRS* associated with the indicated *TCI-State* or *TCI-UL-State*, or by *p0AlphaSetforSRS* associated with the *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CE

- else, if *followUnifiedTCI-StateSRS* is not provided for a SRS resource set and for a SRS resource from the SRS resource set, the values of $P\_{O\\_UE\\_SRS,b,f,c}\left(q\_{s}\right)$, $α\_{SRS,b,f,c}\left(q\_{s}\right)$, and SRS power control adjustment state $l$ are provided by *p0AlphaSetforSRS* associated with *TCI-State* or *TCI-UL-State* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set and a RS index $q\_{d}$ for obtaining a pathloss estimate for the SRS transmission is provided by *pathlossReferenceRS-Id-r17* associated with or included in the *TCI-State* or *TCI-UL-State* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set

$P\_{O\\_SRS,b,f,c}\left(q\_{s}\right)$ is the sum of the component $P\_{O\\_UE\\_SRS,b,f,c}\left(q\_{s}\right)$ and a component *p0* provided by *SRS-ResourceSet* corresponding to the SRS resource set.

In the remaining of this clause, if a PDCCH reception by a UE includes two PDCCH candidates from corresponding search space sets, as described in clause 10.1

- a PDCCH monitoring occasion is the union of the PDCCH monitoring occasions for the two PDCCH candidates

- the end of the PDCCH reception is the end of the PDCCH candidate that ends later

The PDCCH reception includes the two PDCCH candidates also when the UE is not required to monitor one of the two PDCCH candidates as described in clauses 10 (except clause 10.4), 11.1, 11.1.1 and 17.2.

\*\*\* unchanged part omitted \*\*\*

### 7.1.1 UE behaviour

If a UE transmits a PUSCH on active UL BWP $b$ of carrier $f$ of serving cell $c$ using parameter set configuration with index $j$ and PUSCH power control adjustment state with index $l$

- if the UE is indicated a first *TCI-State* or *TCI-UL-State* and a second *TCI-State* or *TCI-UL-State*, and is configured with *multipanelScheme,* and the UE determines to apply both the first *TCI-State* or *TCI-UL-State* and the second *TCI-State* or *TCI-UL-S*tate in PUSCH transmission occasion $i$, the UE determines the PUSCH transmission power $P\_{PUSCH,b,f,c, k}(i,j,q\_{d},l)$ for the k-th indicated *TCI-State* or *TCI-UL-State* as

$P\_{PUSCH,b,f,c,k}\left(i,j,q\_{d},l\right)=min\left\{\begin{matrix}P\_{CMAX,f,c,k}\left(i\right)\\P\_{O\\_PUSCH,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}∙M\_{RB,b,f,c}^{PUSCH}\left(i\right)\right)+α\_{b,f,c}\left(j\right)∙PL\_{b,f,c}\left(q\_{d}\right)+∆\_{TF,b,f,c}\left(i\right)+f\_{b,f,c}\left(i,l\right) \end{matrix}\right\}$ [dBm]

- else, the UE determines the PUSCH transmission power $P\_{PUSCH,b,f,c}(i,j,q\_{d},l)$ in PUSCH transmission occasion $i$ as

$P\_{PUSCH,b,f,c}\left(i,j,q\_{d},l\right)=min\left\{\begin{matrix}P\_{CMAX,f,c}\left(i\right)\\P\_{O\\_PUSCH,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}∙M\_{RB,b,f,c}^{PUSCH}\left(i\right)\right)+α\_{b,f,c}\left(j\right)∙PL\_{b,f,c}\left(q\_{d}\right)+∆\_{TF,b,f,c}\left(i\right)+f\_{b,f,c}\left(i,l\right) \end{matrix}\right\}$ [dBm]

where,

- $P\_{CMAX,f,c,k}(i)$ is the UE configured maximum output power for the k-th indicated *TCI-State* or *TCI-UL-State* defined in [8-2, TS 38.101-2] for carrier $f$ of serving cell $c$ in PUSCH transmission occasion $i$ .

- $P\_{CMAX,f,c}(i)$ is the UE configured maximum output power defined in [8-1, TS 38.101-1], [8-2, TS 38.101-2], [8-3, TS 38.101-3] and [8-5, TS 38.101-5] for carrier $f$ of serving cell $c$ in PUSCH transmission occasion $i$.

- $P\_{O\\_PUSCH,b,f,c}(j)$ is a parameter composed of the sum of a component $P\_{O\\_NOMINAL,PUSCH,f,c}(j)$ and a component $P\_{O\\_UE\\_PUSCH,b,f,c}(j)$ where $j\in \left\{0,1,…,J-1\right\}$.

- 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,

 $j=0$, $P\_{O\\_UE\\_PUSCH,b,f,c}\left(0\right)=0$, and $P\_{O\\_NOMINAL,PUSCH,f,c}\left(0\right)=P\_{O\\_PRE}+∆\_{PREAMBLE,Msg3}$,

where $P\_{O\\_PRE}$ is provided by *preambleReceivedTargetPower* [11, TS 38.321] and $Δ\_{PREAMBLE\\_Msg3}$ is provided by *msg3-DeltaPreamble* or *deltaPreamble*, or $∆\_{PREAMBLE,Msg3}=0$ dB if *msg3-DeltaPreamble* and *deltaPreamble* are not provided, for carrier $f$ of serving cell $c$

- 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,

 $j=0$, $P\_{O\\_UE\\_PUSCH,b,f,c}(0)=0$, and $P\_{O\\_NOMINAL\\_PUSCH,f,c}(0)=P\_{O\\_PRE}+Δ\_{MsgA\\_PUSCH}$,

where $P\_{O\\_PRE}$ is provided by *msgA-preambleReceivedTargetPower*, or by *preambleReceivedTargetPower* if *msgA-preambleReceivedTargetPower* isnot provided and $Δ\_{MsgA\\_PUSCH}$ is provided by *msgA-DeltaPreamble* or *deltaPreamble*, or $Δ\_{MsgA\\_PUSCH}=Δ\_{PREAMBLE\\_Msg3}$ dB if *msgA-DeltaPreamble* and *deltaPreamble* are not provided, for carrier $f$ of serving cell $c$

- For a PUSCH (re)transmission configured by *ConfiguredGrantConfig*, $j=1$, $P\_{O\\_NOMINAL,PUSCH,f,c}\left(1\right)$ is provided by *p0-NominalWithoutGrant*, or $P\_{O\\_NOMINAL,PUSCH,f,c}\left(1\right)=P\_{O\\_NOMINAL,PUSCH,f,c}\left(0\right)$ if *p0-NominalWithoutGrant* is not provided.

- If the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format that includes a SRS resource set indicator field, and for active UL BWP $b$ of carrier $f$ of serving cell

- If the SRS resource set indicator value is 00, first $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ value is provided by the value of *p0-PUSCH-Alpha* in *ConfiguredGrantConfig*.

- If the SRS resource set indicator value is 01, second $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ value is provided by the value of *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig*.

- If the SRS resource set indicator value is 10 or 11, first and second $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ values that are respectively associated with the first and second SRS resource set are respectively provided by the values of *p0-PUSCH-Alpha* and by *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig*.

- else if the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a transmission of a configured grant Type 1 PUSCH and for active UL BWP $b$ of carrier $f$ of serving cell

- a first $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ value is provided by the value of *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that is associated with the first *srs-ResourceIndicator* in *rrc-ConfiguredUplinkGrant*

- a second $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ value is provided by the value of *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig* that is associated with the second *srs-ResourceIndicator* in *rrc-ConfiguredUplinkGrant*

- else if the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format 0\_0, and for active UL BWP $b$ of carrier $f$ of serving cell

- a first $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ value is provided by the value of *p0-PUSCH-Alpha* in *ConfiguredGrantConfig*

- else, $P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ 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*, or by *sdt*-*P0-PUSCH* for a PUSCH (re)transmission as described in clause 19.1, or by *rrc-P0-PUSCH* for a PUSCH (re)transmission as described in clause 22.1, or by *p0* of *p0AlphaSetforPUSCH* associated with the *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CEfor a configured grant Type-1 PUSCH (re)transmission as described in clause [21.1], for active UL BWP $b$ of carrier $f$ of serving cell $c$

\*\*\* unchanged part omitted \*\*\*

- For $α\_{b,f,c}\left(j\right)$

- For $j=0$,

- if $P\_{O\\_NOMINAL\\_PUSCH,f,c}(0)=P\_{O\\_PRE}+Δ\_{MsgA\\_PUSCH}$ and *msgA-Alpha* is provided, $α\_{b,f,c}(0)$ is the value of *msgA-Alpha*

- elseif $P\_{O\\_NOMINAL\\_PUSCH,f,c}(0)=P\_{O\\_PRE}+Δ\_{PREAMBLE\\_Msg3}$ or *msgA-Alpha* is not provided, and *msg3-Alpha* is provided, $α\_{b,f,c}(0)$ is the value of *msg3-Alpha*

- else, $α\_{b,f,c}\left(0\right)=1$

- For $j=1$,

- if the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format that includes an SRS resource set indicator field, and for active UL BWP $b$ of carrier $f$ of serving cell

- if the SRS resource set indicator value is '00', first $α\_{b,f,c}(1)$ value is provided by *p0-PUSCH-Alpha* in *ConfiguredGrantConfig*

- if the SRS resource set indicator value is '01', first $α\_{b,f,c}(1)$ value is provided by *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig*

- if the SRS resource set indicator value is '10' or '11', first and second $α\_{b,f,c}(1)$ values associated with the first and second SRS resource set are respectively provided by *p0-PUSCH-Alpha* and *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig*

- else if the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a transmission of a configured grant Type 1 PUSCH and for active UL BWP $b$ of carrier $f$ of serving cell

- a first $α\_{b,f,c}(1)$ value is provided by the value of *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* that is associated with the first *srs-ResourceIndicator* in *rrc-ConfiguredUplinkGrant*.

- a second $α\_{b,f,c}(1)$ value is provided by the value of *p0-PUSCH-Alpha2* in *ConfiguredGrantConfig* that is associated with the second *srs-ResourceIndicator* in *rrc-ConfiguredUplinkGrant*.

- else if the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' and is provided *p0-PUSCH-Alpha2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format 0\_0 and for active UL BWP $b$ of carrier $f$ of serving cell

- a first$P\_{O\\_UE\\_PUSCH,b,f,c}\left(1\right)$ $α\_{b,f,c}(1)$ value is provided by the value of *p0-PUSCH-Alpha* in *ConfiguredGrantConfig.*

- else $α\_{b,f,c}(1)$ is provided by *alpha* obtained from *p0-PUSCH-Alpha* in *ConfiguredGrantConfig* providing an index *P0-PUSCH-AlphaSetId* to a set of *P0-PUSCH-AlphaSet*, or by *sdt*-*Alpha* for a PUSCH (re)transmission as described in clause 19.1, or by *rrc-Alpha* for a PUSCH (re)transmission as described in clause 22.1, or by *alpha* of *p0AlphaSetforPUSCH* associated with the *CandidateTCI-State* or *CandidateTCI-UL-State* indicated in the LTM Cell Switch Command MAC CEfor a configured grant Type-1 PUSCH (re)transmission as described in clause [21.1], for active UL BWP $b$ of carrier $f$ of serving cell $c$