**3GPP TSG-RAN WG1 Meeting #**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** | **16.6.0** |  |
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| *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:*** | Clarification on PUCCH Power control | | | | | | | | | |
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| ***Source to WG:*** | Moderator(vivo) | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
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| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
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| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *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 can be 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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | If a PUCCH format2/3/4 is used for SL HARQ-ACK reporting and the number of SL HARQ-ACK bits is larger than 11, how to determine  for PUCCH power calculation is missing.  When the number of HARQ-ACK bits is <=11 bits, it remains unclear that whether  should be set to the number of SL HARQ-ACK bits determined in clauses 16.5.1.1 and 16.5.2.1. | | | | | | | | |
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| ***Summary of change:*** | | Clarify in 7.2.1 that  and are the number of SL HARQ-ACK bits determined in clauses 16.5.1.1 and 16.5.2.1 for the case where the PUCCH is used to carrying <=11 bits SL HARQ-ACK or >11 bits SL HARQ-ACK, respectively. | | | | | | | | |
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| ***Consequences if not approved:*** | | It remains unclear how to determine the transmission power of a PUCCH for sidelink HARQ-ACK reporting | | | | | | | | |
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| ***Clauses affected:*** | | 7.2.1 | | | | | | | | |
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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 ... | | |
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| ***Other comments:*** | | **Isolated impact analysis:**  This CR aligns with RAN1’s common understanding  . | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

### 7.2.1 UE behaviour

If a UE transmits a PUCCH on active UL BWP  of carrier  in the primary cell  using PUCCH power control adjustment state with index , the UE determines the PUCCH transmission power  in PUCCH 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 primary cell  in PUCCH transmission occasion 

-  is a parameter composed of the sum of a component , provided by *p0-nominal*, or  dBm if *p0-nominal* is not provided, for carrier  of primary cell  and, if provided, a component  provided by *p0-PUCCH-Value* in *P0-PUCCH* for active UL BWP  of carrier  of primary cell , where .  is a size for a set of  values provided by *maxNrofPUCCH-P0-PerSet*. The set of  values is provided by *p0-Set*. If *p0-Set* is not provided to the UE, , 

- If the UE is provided *PUCCH-SpatialRelationInfo*, the UE obtains a mapping, by an index provided by *p0-PUCCH-Id*, between a set of *pucch-SpatialRelationInfoId* values and a set of *p0-PUCCH-Value* values. If the UE is provided more than one values for *pucch-SpatialRelationInfoId* and the UE receives an activation command [11, TS 38.321] indicating a value of *pucch-SpatialRelationInfoId*, the UE determines the *p0-PUCCH-Value* value through the link to a corresponding *p0-PUCCH-Id* index. The UE applies the activation command in the first slot that is after slot  where  is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the activation command and  is the SCS configuration for the PUCCH

- If the UE is not provided *PUCCH-SpatialRelationInfo*, the UE obtains the *p0-PUCCH-Value* value from the *P0-PUCCH* with *p0-PUCCH-Id* value equal to the minimum *p0-PUCCH-Id* value in *p0-Set*

-  is a bandwidth of the PUCCH resource assignment expressed in number of resource blocks for PUCCH transmission occasion on active UL BWP  of carrier  of primary cell and  is a SCS configuration defined in [4, TS 38.211]

- is a downlink pathloss estimate in dB calculated by the UE using RS resource index  as described in clause 7.1.1 for the active DL BWP  of carrier  of the primary cell  as described in clause 12

- If the UE is not provided *pathlossReferenceRSs* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from an SS/PBCH block with same SS/PBCH block index as the one the UE uses to obtain *MIB*

- If the UE is provided a number of RS resource indexes, the UE calculates  using RS resource with index , where .  is a size for a set of RS resources provided by *maxNrofPUCCH-PathlossReferenceRSs*. The set of RS resources is provided by *pathlossReferenceRSs*. The set of RS resources can include one or both of a set of SS/PBCH block indexes, each provided by *ssb-Index* in *PUCCH-PathlossReferenceRS* when a value of a corresponding *pucch-PathlossReferenceRS-Id* maps to a SS/PBCH block index, and a set of CSI-RS resource indexes, each provided by *csi-RS-Index* when a value of a corresponding *pucch-PathlossReferenceRS-Id* maps to a CSI-RS resource index. The UE identifies a RS resource in the set of RS resources to correspond either to a SS/PBCH block index or to a CSI-RS resource index as provided by *pucch-PathlossReferenceRS-Id* in *PUCCH-PathlossReferenceRS*

- If the UE is provided *pathlossReferenceRSs* and *PUCCH-SpatialRelationInfo*, the UE obtains a mapping, by indexes provided by corresponding values of *pucch-PathlossReferenceRS-Id*, between a set of *pucch-SpatialRelationInfoId* values and a set of *referenceSignal* values provided by *PUCCH-PathlossReferenceRS*. If the UE is provided more than one values for *pucch-SpatialRelationInfoId* and the UE receives an activation command [11, TS 38.321] indicating a value of *pucch-SpatialRelationInfoId*, the UE determines the *referenceSignal* value in *PUCCH-PathlossReferenceRS* through the link to a corresponding *pucch-PathlossReferenceRS-Id* index. The UE applies the activation command in the first slot that is after slot  where  is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the activation command and  is the SCS configuration for the PUCCH

- If *PUCCH-SpatialRelationInfo* includes *servingCellId* indicating a serving cell, the UE receives the RS for resource index  on the active DL BWP of the serving cell

- If the UE is provided *pathlossReferenceRSs* and is not provided *PUCCH-SpatialRelationInfo*, the UE obtains the *referenceSignal* value in *PUCCH-PathlossReferenceRS* from the *pucch-PathlossReferenceRS-Id* with index 0 in *PUCCH-PathlossReferenceRS* where the RS resource is either on the primary cell or, if provided, on a serving cell indicated by a value of *pathlossReferenceLinking*

- If the UE

- is not provided *pathlossReferenceRSs*, and

- is not provided *PUCCH-SpatialRelationInfo,* and

- is provided *enableDefaultBeamPL-ForPUCCH*, and

- is not provided coresetPoolIndex value of 1 for any CORESET, or is provided coresetPoolIndex value of 1 for all CORESETs, in ControlResourceSet and no codepoint of a TCI field, if any, in a DCI format of any search space set maps to two TCI states [5, TS 38.212]

the UE determines a RS resource index providing a periodic RS resource configured with *qcl-Type* set to 'typeD' in the TCI state or the QCL assumption of a CORESET with the lowest index in the active DL BWP of the primary cell. For a PUCCH transmission over multiple slots, a same applies to the PUCCH transmission in each of the multiple slots.

- The parameter  is a value of *deltaF-PUCCH-f0* for PUCCH format 0, *deltaF-PUCCH-f1* for PUCCH format 1, *deltaF-PUCCH-f2* for PUCCH format 2, *deltaF-PUCCH-f3* for PUCCH format 3, and *deltaF-PUCCH-f4* for PUCCH format 4, if provided; otherwise .

-  is a PUCCH transmission power adjustment component on active UL BWP  of carrier  of primary cell 

- For a PUCCH transmission using PUCCH format 0 or PUCCH format 1,  where

-  is a number of PUCCH format 0 symbols or PUCCH format 1 symbols for the PUCCH transmission as described in clause 9.2.

-  for PUCCH format 0

-  for PUCCH format 1

-  for PUCCH format 0

-  for PUCCH format 1, where  is a number of UCI bits in PUCCH transmission occasion 

- For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits smaller than or equal to 11, , where

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-  is a number of HARQ-ACK information bits that the UE determines as described in clause 9.1.2.1 or 16.5.1.1 for Type-1 HARQ-ACK codebook and as described in clause 9.1.3.1 or 9.1.3.3 or 16.5.2.1 for Type-2 HARQ-ACK codebook.is the same as  as described in clause 9.1.4 for Type-3 HARQ-ACK codebook. If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise, 

-  is a number of SR information bits that the UE determines as described in clause 9.2.5.1

-  is a number of CSI information bits that the UE determines as described in clause 9.2.5.2

-  is a number of resource elements determined as , where  is a number of subcarriers per resource block excluding subcarriers used for DM-RS transmission, and  is a number of symbols excluding symbols used for DM-RS transmission, as defined in clause 9.2.5.2, for PUCCH transmission occasion on active UL BWP  of carrier  of primary cell

- For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits larger than 11, , where

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-  is a number of HARQ-ACK information bits that the UE determines as described in clause 9.1.2.1 or 16.5.1.1 for Type-1 HARQ-ACK codebook and as described in clause 9.1.3.1 or 9.1.3.3 or 16.5.2.1 for Type-2 HARQ-ACK codebook, or as described in clause 9.1.4 for Type-3 HARQ-ACK codebook. If the UE is not provided any of *pdsch-HARQ-ACK-Codebook*, *pdsch-HARQ-ACK-Codebook-r16*, or *pdsch-HARQ-ACK-OneShotFeedback*,  if the UE includes a HARQ-ACK information bit in the PUCCH transmission; otherwise, 

-  is a number of SR information bits that the UE determines as described in clause 9.2.5.1

-  is a number of CSI information bits that the UE determines as described in clause 9.2.5.2

-  is a number of CRC bits that the UE determines as described in clause 9.2

-  is a number of resource elements that the UE determines as , where  is a number of subcarriers per resource block excluding subcarriers used for DM-RS transmission, and  is a number of symbols excluding symbols used for DM-RS transmission, as defined in clause 9.2.5.2, for PUCCH transmission occasion on active UL BWP  of carrier  of primary cell.