**3GPP TSG- Meeting # *R1-240xxxx***

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** | **---** | **rev** |  | **Current version:** |  |  |
|  | | | | | | | | |
| *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 PT-RS Coherence Conditions for 8 Tx | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Moderator (NTT DOCOMO), | | | | | | | | | |
| ***Source to TSG:*** | --- | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | For 2 and 4 port UL MIMO a capability of ‘nonCoherent’, ‘partialCoherent’, or ‘fullCoherent’ is reported using *pusch-TransCoherence*. According to *pusch-TransCoherence*, the UE supports a full/partial/noncoherent, partial/noncoherent, or noncoherent codebook subset for 2 or 4 ports.  For 8 port UL MIMO, the UE reports support for one or more of ‘codebook1’, ‘codebook2’, ‘codebook3’, or ‘codebook4’, each of which corresponds to a number of antenna port groups, and where the UE maintains coherence within each group. Codebook subsets are not supported for 8 ports, and UEs are instead reconfigured with different values of *CodebookTypeUL* to use precoders with different numbers of mutually coherent elements.  Therefore, UEs can be configured for ‘full coherent’, ‘partial coherent’, or ‘non-coherent’ operation with 2 or 4 antenna ports, but not with 8 antenna ports, where the UE instead can be configured for a codebook with its corresponding number of antenna port groups. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Full-, partial-, and non-coherent operation is associated with 2 and 4 port operation, while the amount of coherence is identified by corresponding value(s) of *CodebookTypeUL* for 8 antenna ports.  An editorial change was made as well, adding a space in ‘ULPTRS’ in the sentence just after the first change. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | For 8 antenna port UL MIMO with PT-RS configured, the UE and the network will not know the number of PT-RS ports to use, the number of PUSCH layers in the antenna port group which are precoded coherently with the PUSCH layer/DM-RS port that PT-RS port x is associated with, and/or PUSCH to PT-RS power ratio per layer per RE. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2.3.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **N** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

6.2.3.1 UE PT-RS transmission procedure when transform precoding is not enabled

When transform precoding is not enabled and if a UE is configured with the higher layer parameter *phaseTrackingRS* in *DMRS-UplinkConfig,*

<Unchanged part omitted>

If a UE has reported the capability of supporting full-coherent UL transmission with 2 or 4 antenna ports or the capability of *codebook1-8TxPUSCH-r18* with 8 antenna ports, the UE shall expect *maxNrofPorts* in *PTRS-UplinkConfig* to be configured as one if UL PT-RS is configured. If a UE has reported the capability of supporting full-coherent UL transmission and when the higher layer parameter *multipanelScheme* is set to 'sdmscheme', subject to UE capability, the UE can be configured with *maxNrofPortsforSDM* in *PTRS-UplinkConfig* set to n2, where at most one PT-RS port is associated with each SRS resource set with higher layer parameter *usage* set to 'codebook'/'nonCodebook'.

For codebook or non-codebook based UL transmission, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1, 0\_2 and 0\_3. For a PUSCH corresponding to a configured grant Type 1 transmission, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25, or value "00" in Table 7.3.1.1.1.2-26 or value "00" in Table 7.3.1.1.1.2-25a described in Clause 7.3.1 of [5, TS38.212].

For PUSCH scheduled by DCI format 0\_0 or by activation DCI format 0\_0, the UL PT-RS port is associated to DM-RS port 0.

For non-codebook based UL transmission, the actual number of UL PT-RS port(s) to transmit is determined based on SRI(s) in DCI format 0\_1, 0\_2 or 0\_3 or higher layer parameter *sri-ResourceIndicator* in *rrc-ConfiguredUplinkGrant*. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'noncodebook', the actual number of UL PT-RS port(s) to transmit corresponding to each SRS resource set is determined based on SRI(s) corresponding to the associated SRS resource set or higher layer parameter *sri-ResourceIndicator or sri-ResourceIndicator2* corresponding to the associated SRS resource set in *rrc-ConfiguredUplinkGrant*. A UE is configured with the PT-RS port index for each configured SRS resource by the higher layer parameter *ptrs-PortIndex* configured by *SRS-Config* if the UE is configured with the higher layer parameter *phaseTrackingRS in DMRS-UplinkConfig*. If the PT-RS port index associated with different SRIs are the same, the corresponding UL DM-RS ports are associated to the one UL PT-RS port.

When the higher layer parameter *multipanelScheme* is set to 'sdmscheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/'nonCodebook' and higher layer parameter *maxNrofPortsforSDM* in *PTRS-UplinkConfig* set to n2, the actual number of UL PT-RS port(s) to transmit corresponding to SRS resource sets is *2*.

When the higher layer parameter *multipanelScheme* is set to 'SFNscheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/'nonCodebook' and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n2*, the actual number of UL PT-RS port(s) to transmit corresponding to each SRS resource set is determined based on 1st TPMI codepoint field for 'codebook' or 1st SRI(s) codepoint field for 'nonCodebook'.

For partial-coherent and non-coherent codebook-based UL transmission with 2 or 4 antenna ports or when the higher layer parameter *CodebookTypeUL* is set to ‘codebook2’, ‘codebook3’, or ‘codebook4’ with 8 antenna ports, the actual number of UL PT-RS port(s) is determined based on TPMI(s) and/or number of layers which are indicated by '*Precoding information and number of layers'* field(s) in DCI format 0\_1, 0\_2 or 0\_3 or configured by higher layer parameter *precodingAndNumberOfLayers*:

- if the UE is configured with the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* set to 'n2', the actual UL PT-RS port(s) and the associated transmission layer(s) are derived from indicated TPMI(s) as:

- for PUSCH transmission with 2 or 4 ports, PUSCH antenna port 1000 and 1002 in indicated TPMI(s) share PT-RS port 0, and PUSCH antenna port 1001 and 1003 in indicated TPMI(s) share PT-RS port 1.

- UL PT-RS port 0 is associated with the UL layer 'x' of layers which are transmitted with PUSCH antenna port 1000 and PUSCH antenna port 1002 in indicated TPMI(s), and UL PT-RS port 1 is associated with the UL layer 'y' of layers which are transmitted with PUSCH antenna port 1001 and PUSCH antenna port 1003 in indicated TPMI(s), where 'x' and/or 'y' are given by DCI parameter '*PTRS-DMRS association'* as shown in DCI format 0\_1, 0\_2 and 0\_3 described in Clause 7.3.1 of [5, TS38.212].

- for PUSCH transmission with 8 ports, PUSCH antenna port 1000, 1001, 1004 and 1005 in indicated TPMI(s) share PT-RS port 0, and PUSCH antenna port 1002, 1003, 1006 and 1007 in indicated TPMI(s) share PT-RS port 1.

- UL PT-RS port 0 is associated with the UL layer 'x' of layers which are transmitted with one or more of PUSCH antenna port 1000, 1001, 1004 and 1005 in indicated TPMI(s), and UL PT-RS port 1 is associated with the UL layer 'y' of layers which are transmitted with one or more of PUSCH antenna port 1002, 1003, 1006 and 1007 in indicated TPMI(s), where 'x' and/or 'y' are given by DCI parameter '*PTRS-DMRS association*' as shown in DCI format 0\_1 and DCI format 0\_2 described in Clause 7.3.1 of [5, TS38.212].

If a UE is scheduled with two codewords,

- if the UE is configured with the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* set to 'n1', the PT-RS port is associated with the one of DM-RS ports indicated by DCI field *PTRS-DMRS association* for the codeword with the higher MCS. If the MCS indices of the two codewords are the same, the PT-RS antenna port is associated with codeword 0. When a codeword is scheduled to transmit PUSCH for retransmission, the MCS for determining PT-RS association to codeword is obtained from the DCI for the same transport block in the initial transmission.

When the UE is scheduled with *Qp*={1,2} PT-RS port(s) in uplink and the number of scheduled layers is ,

- If the UE is configured with higher layer parameter *ptrs-Power*, the PUSCH to PT-RS power ratio per layer per RE  is given by , where  is shown in the Table 6.2.3.1-3, Table 6.2.3.1-3A and Table 6.2.3.1-3B according to the higher layer parameter *ptrs-Power*, the PT-RS scaling factor  specified in clause 6.4.1.2.2.1 of [4, TS 38.211] is given by and also on the '*Precoding Information and Number of Layers'* field in DCI.

- The UE shall assume *ptrs-Power* in *PTRS-UplinkConfig* is set to state "00" in Table 6.2.3.1-3, Table 6.2.3.1-3A, and Table 6.2.3.1-3B if not configured or in case of non-codebook based PUSCH.

When the higher layer parameter *CodebookTypeUL* is set to ‘codebook2’or ‘codebook3’ for 8 antenna porttransmission, *Lx* is the number of PUSCH layers in the antenna port group which are precoded coherently with the PUSCH layer/DM-RS port that PT-RS port x is associated with, and *Qp* is the number of PT-RS ports scheduled to the UE.

- When the higher layer parameter *multipanelScheme* is set to ‘sdmscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’, and codepoint "10" of *SRS Resource Set* *indicator* is indicated, for each PT-RS port is based on Table 6.2.3.1-3B, where *Qp* is the total number of PT-RS ports for the PUSCH.

**Table 6.2.3.1-3: Factor related to PUSCH to PT-RS power ratio per layer per RE  other than 8TX PUSCH transmission and other than SDM PUSCH**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***UL-PTRS-power /*** |  | **The number of PUSCH layers ( )** | | | | | | |
| **1** | **2** | | **3** | | **4** | | |
| All cases | Full coherent | Partial and non- coherent and non-codebook based | Full coherent | Partial and non- coherent and non-codebook based | Full coherent | Partial coherent | Non-coherent and non-codebook based |
| 00 | 0 | 3 | 3*Qp*-3 | 4.77 | 3*Qp*-3 | 6 | 3*Qp* | 3*Qp*-3 |
| 01 | 0 | 3 | 3 | 4.77 | 4.77 | 6 | 6 | 6 |
| 10 | Reserved | | | | | | | |
| 11 | Reserved | | | | | | | |

**Table 6.2.3.1-3A: Factor related to PUSCH to PT-RS power ratio per layer per RE  for 8TX PUSCH transmission**

|  |  |  |  |
| --- | --- | --- | --- |
| ***UL-PTRS-power /*** | **The number of PUSCH layers ()** | | |
| **1-8** | | |
| *CodebookTypeUL* =‘codebook1’ | *CodebookTypeUL* =‘codebook2’ or ‘codebook3’ | *CodebookTypeUL* =‘codebook4’ |
| 00 |  |  |  |
| 01 |  |  |  |
| 10 | Reserved | | |
| 11 | Reserved | | |

**Table 6.2.3.1-3B: Factor related to PUSCH to PT-RS power ratio per layer per RE for SDM PUSCH**

|  |  |  |  |
| --- | --- | --- | --- |
| ***UL-PTRS-power /*** | **The number of PUSCH layers associated with the same SRS resource set as the PT-RS port** | | |
| **1** | **2** | |
| All cases | Full coherent | Partial and non- coherent and non-codebook based |
| 00 | 3*Qp*-3 | 3*Qp* | 3*Qp*-3 |
| 01 | 3*Qp*-3 | 3*Qp* | 3*Qp* |
| 10 | Reserved | | |
| 11 | Reserved | | |

<Unchanged part omitted>