**3GPP TSG RAN WG1 #102-e- R1-200xxxx**

**e-Meeting, August 17th – 28th, 2020**

Source: moderator (vivo)

Title: Summary on 102-e-NR-eMIMO-08

Agenda Item: 7.2.6

Document for: Discussion and Decision

1. Introduction

In this contribution, following two issues are discussed according to agreement of preparatory email discussion.

1. Remaining issues
   1. Issue 5: TP on 2-port PTRS for ULFP mode1

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

< Unchanged parts are omitted >

For partial-coherent and non-coherent codebook based UL transmission, the actual number of UL PT-RS port(s) is determined based on TPMI and/or number of layers which are indicated by *Precoding information and number of layers* field in DCI format 0\_1 or configured by higher layer parameter *precodingAndNnumberOfLayers*:

- 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 as:

- PUSCH antenna port 1000 and 1002 in indicated TPMI share PT-RS port 0, and PUSCH antenna port 1001 and 1003 in indicated TPMI share PT-RS port 1 except for the cases that *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and TPMI=2 in Table 6.3.1.5-1, or one of the TPMI 12-15 in Table 6.3.1.5-2 and Table 6.3.1.5-3 in [4, TS 38.211] is indicated.

- 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, 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, where [x] and/or [y] are given by DCI parameter *PTRS-DMRS association* as shown in DCI format 0\_1 described in Clause 7.3.1 of [5, TS38.212].

- For the cases that *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and TPMI=2 in Table 6.3.1.5-1, or one of the TPMI 12-15 in Table 6.3.1.5-2 and Table 6.3.1.5-3 in [4, TS 38.211] is indicated, PUSCH antenna port 1000, 1001, 1002 and 1003 in the indicated TPMI share PT-RS port 0.

< Unchanged parts are omitted >

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| --- | --- |
| Company | Comments |
| ZTE | Regarding the rationale of this TP, we agree with it in principle but we doubt it in practice.  From our perspective, 2 PT-RS ports are still needed to the multi-port non/ partial-coherence UEs in Mode 1 with Rank1 based transmission, because the phase variations caused by phase noise in the oscillators also will harm the performance of the related PUSCH transmission, especially in FR2 and where the phase noise tends to be higher. However, we also notice that when the Rank 1 and fully coherence TPMIs are used for the non/ partial-coherent UEs, there is only one DM-RS port can be indicated to the 2 PT-RS ports. Hence, we suggest that when RRC configured 2 PT-RS ports and full power Mode 1 to the 2/4-port non/partial-coherent UEs, the TPMI=2 in Table 6.3.1.5-1 and/or one of the TPMI 12-15 in Table 6.3.1.5-2 and Table 6.3.1.5-3 in [4, TS 38.211] can not be indicated. |
| CATT | In our understanding, what matters to implementation is the correct association between PTRS ports and DMRS ports so that channel tracking can be done correctly at gNB. The description of PTRS ports and PUSCH/SRS ports are an intermediate step to assist identification of DMRS ports, for normal cases currently in 38.212  Therefore, for the special case of mode-1 as the result of rank-1 full-coherent TPMI, what needs to be defined is the association of PTRS port 0 and DMRS port index of the single layer. PUSCH port does not need to be involved/ A revised TP is below.   * For the cases that *ul-FullPowerTransmission* is configured to *fullpowerMode1*, and TPMI=2 in Table 6.3.1.5-1, or one of the TPMI 12-15 in Table 6.3.1.5-2 and Table 6.3.1.5-3 in [4, TS 38.211] is indicated, UL PTRS port 0 is associated with the indicated UL layer. . |
| Huawei, HiSilicon | Support the TP, but the RRC name can be updated accordingly:  *ul-FullPowerTransmission 🡪 ul-FullPowerTransmission-r16*  Then, for the comments from CATT, in our understanding, we should keep the spec consistent. We have introduce the mapping between PTRS ports and PUSCH ports in Rel-15, so we prefer to keep it as it is. The mentioned “UL layer” is the same for PUSCH ports 100~1003 for the discussed TPMIs for Mode-1.  For ZTE’s comment, in our understanding, for non or partial cherent precoding, different port (or port group) is with different phase noise/shifting, so anyway need different PTRS ports to reflector the differentiation between the PUSCH port/port group. With Mode-1, although multiple ports are enabled for simulatanously transmission, but the factors on the difference of phase noise is not changed. So, it is better to include the changes. |
| Intel | Support the proposal. |
| OPPO | Fine with either the original proposal or CATT’s modification. There is no much difference between them |
| LG | We share the same view with OPPO. Thus, we are fine with original proposal or modification from CATT. |
| Apple | In our view, full power mode 1 is closed to coherent transmission, where only 1 PT-RS port is necessary. We do not see the reason to use 2 port PT-RS. |
| Spreadtrum | Support the proposal |

* 1. Issue 4: alignment of RRC parameter names

------------------------------------------Start of Text Proposal#2 for TS 38.213--------------------------------------

**7.1 Physical uplink shared channel**

For a PUSCH transmission on active UL BWP , as described in Clause 12, of carrier  of serving cell , a UE first calculates a linear value  of the transmit power , with parameters as defined in Clause 7.1.1. For a PUSCH transmission scheduled by a DCI format other than DCI format 0\_0, or configured by *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, if *txConfig* in *PUSCH-Config* is set to 'codebook',

- if *ul-FullPowerTransmission-r16* in *PUSCH-Config* is provided, the UE scales by where:

- if *ul-FullPowerTransmission-r16* in *PUSCH-Config* is set to *fullpowerMode1*, and each SRS resource in the *SRS-ResourceSet* with *usage* set to 'codebook' has more than one SRS port, is the ratio of a number of antenna ports with non-zero PUSCH transmission power over the maximum number of SRS ports supported by the UE in one SRS resource

- if *ul-FullPowerTransmission-r16* in *PUSCH-Config* is set to *fullpowerMode2*,

- for full power TPMIs reported by the UE [16, TS 38.306], and is the ratio of a number of antenna ports with non-zero PUSCH transmission power over a number of SRS ports for remaining TPMIs, where the number of SRS ports is associated with a SRS resource indicated by a SRI field in a DCI format scheduling the PUSCH transmission if more than one SRS resource is configured in the *SRS-ResourceSet* with *usage* set to 'codebook', or indicated by Type 1 configured grant, or the number of SRS ports is associated with the SRS resource if only one SRS resource is configured in the *SRS-ResourceSet* with *usage* set to 'codebook',

- , if a SRS resource with a single port is indicated by a SRI field in a DCI format scheduling the PUSCH transmission when more than one SRS resource is provided in the *SRS-ResourceSet* with *usage* set to 'codebook', or indicated by Type 1 configured grant, or if only one SRS resource with a single port is provided in the *SRS-ResourceSet* with *usage* set to 'codebook', and

- if *ul-FullPowerTransmission-r16* in *PUSCH-Config* is set to *fullpower*,

------------------------------------------End of Text Proposal#2 for TS 38.213--------------------------------------

---------------------------------------Start of Text Proposal for TS 38.214-----------------------------------------

**6.1.1.1 Codebook based UL transmission**

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For codebook based transmission, the UE determines its codebook subsets based on TPMI and upon the reception of higher layer parameter *codebookSubset* in *pusch-Config* for PUSCH associated with DCI format 0\_1 and *codebookSubset-ForDCIFormat0\_2* in *pusch-Config* for PUSCH associated with DCI format 0\_2 which may be configured with *'*fullyAndPartialAndNonCoherent*'*, or *'*partialAndNonCoherent*'*, or 'nonCoherent' depending on the UE capability. When higher layer parameter ul-FullPowerTransmission*-r16* is set to 'fullpowerMode2'and the higher layer parameter codebookSubset or the higher layer parameter codebookSubset-ForDCIFormat0\_2 is set to 'partialAndNonCoherent', and when the SRS-resourceSet with usage set to "codebook" includes at least one SRS resource with 4 ports and one SRS resource with 2 ports, the codebookSubset associated with the 2-port SRS resource is 'nonCoherent'. The maximum transmission rank may be configured by the higher layer parameter *maxRank* in *pusch-Config* for PUSCH scheduled with DCI format 0\_1 and *maxRank-ForDCIFormat0\_2* for PUSCH scheduled with DCI format 0\_2*.*

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For codebook based transmission, the UE may be configured with a single *SRS-ResourceSet* with *usage* set to 'codebook' and only one SRS resource can be indicated based on the SRI from within the SRS resource set. Except when higher layer parameter *ul-FullPowerTransmission-r16* is set to '*fullpowerMode2*', the maximum number of configured SRS resources for codebook based transmission is 2. If aperiodic SRS is configured for a UE, the SRS request field in DCI triggers the transmission of aperiodic SRS resources.

A UE shall not expect to be configured with higher layer parameter *ul-FullPowerTransmission-r16* set to '*fullpowerMode1'* and *codebookSubset* or *codebookSubset-ForDCIFormat0\_2* set to *'fullAndPartialAndNonCoherent'* simultaneously.

The UE shall transmit PUSCH using the same antenna port(s) as the SRS port(s) in the SRS resource indicated by the DCI format 0\_1 or 0\_2 or by *configuredGrantConfig* according to clause 6.1.2.3.

The DM-RS antenna ports  in Clause 6.4.1.1.3 of [4, TS38.211] are determined according to the ordering of DM-RS port(s) given by Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 in Clause 7.3.1.1.2 of [5, TS 38.212].

Except when higher layer parameter *ul-FullPowerTransmission-r16* is set to '*fullpowerMode2*', when multiple SRS resources are configured by *SRS-ResourceSet* with *usage* set to 'codebook', the UE shall expect that higher layer parameters *nrofSRS-Ports* in *SRS-Resource* in *SRS-ResourceSet* shall be configured with the same value for all these SRS resources.

When higher layer parameter *ul-FullPowerTransmission-r16* is set to '*fullpowerMode2*',

- the UE can be configured with one SRS resource or multiple SRS resources with same or different number of SRS ports within an SRS resource set with *usage* set to '*codebook*'.

- up to 2 different spatial relations can be configured for all SRS resources in the SRS resource set with usage set to 'codebook' when multiple SRS resources are configured in the SRS resource set.

- subject to UE capability, a maximum of 2 or 4 SRS resources are supported in an SRS resource set with *usage* set to 'codebook'

---------------------------------------End of Text Proposal for TS 38.214------------------------------------------

---------------------------------------Start of Text Proposal for TS 38.212-----------------------------------------

**7.3.1.1.2 Format 0\_1**

---------------------------------------------------Unchanged text omitted-------------------------------------------

- Precoding information and number of layers – number of bits determined by the following:

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 4 or 5 bits according to Table 7.3.1.1.2-2A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16= fullpowerMode1, maxRank=2,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 4 or 6 bits according to Table 7.3.1.1.2-2B for 4 antenna ports, if *txConfig = codebook, ul-FullPowerTransmission-r16= fullpowerMode1,* *maxRank=3 or 4,* transform precoder is disabled, and according to the values of higher layer parameter *codebookSubset*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16= fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

- 2 or 4 bits according to Table7.3.1.1.2-4 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-4A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16= fullpowerMode1*, transform precoder is disabled, *maxRank=2*, and *codebookSubset=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-5A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16= fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the values of higher layer parameter *codebookSubset*;

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission-r16* is configured to *fullpowerMode2*, maxRank is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in an SRS resource set with usage set to 'codebook' and an SRS resource with 2 antenna ports is indicated via SRI in the same SRS resource set, then Table 7.3.1.1.2-4 is used.

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Table 7.3.1.1.2-2: Precoding information and number of layers, for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2 or 3 or 4, and *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

---------------------------------------------------Unchanged text omitted-------------------------------------------

Table 7.3.1.1.2-2A: Precoding information and number of layers for 4 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission-r16 = fullpowerMode1*

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Table 7.3.1.1.2-2B: Precoding information and number of layers for 4 antenna ports, if transform precoder is disabled, *maxRank* = 3 or 4, and *ul-FullPowerTransmission-r16 = fullpowerMode1*

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Table 7.3.1.1.2-3: Precoding information and number of layers for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission-r16* is either not configured or configured to *fullpowerMode2*, or if transform precoder is disabled, *maxRank* = 1, and *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

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Table 7.3.1.1.2-3A: Precoding information and number of layers for 4 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission-r16 = fullpowerMode1*, or if transform precoder is disabled, *maxRank* = 1, and *ul-FullPowerTransmission-r16 = fullpowerMode1*

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Table 7.3.1.1.2-4: Precoding information and number of layers, for 2 antenna ports, if transform precoder is disabled, *maxRank* = 2, and *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

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Table 7.3.1.1.2-4A: Precoding information and number of layers, for 2 antenna ports, if transform precoder is disabled*, maxRank* = 2, and *ul-FullPowerTransmission-r16 = fullpowerMode1*

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Table 7.3.1.1.2-5: Precoding information and number of layers, for 2 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower*, or if transform precoder is disabled, *maxRank* = 1, and and *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower*

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Table 7.3.1.1.2-5A: Precoding information and number of layers, for 2 antenna ports, if transform precoder is enabled and *ul-FullPowerTransmission-r16 = fullpowerMode1*, or if transform precoder is disabled*, maxRank* = 1, and *ul-FullPowerTransmission-r16 = fullpowerMode1*

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Table 7.3.1.1.2-32: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission-r16* is not configured, or *ul-FullPowerTransmission-r16 = fullpowerMode1, or ul-FullPowerTransmission-r16 = fullpowerMode2, or ul-FullPowerTransmission-r16 = fullpower* and

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Table 7.3.1.1.2-32A: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission-r16 = fullpowerMode2* and

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Table 7.3.1.1.2-32B: SRI indication for codebook based PUSCH transmission, if *ul-FullPowerTransmission-r16 = fullpowerMode2* and

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**7.3.1.1.3 Format 0\_2**

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Precoding information and number of layers – number of bits determined by the following:

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank-ForDCIFormat0\_2*, and *codebookSubset-ForDCIFormat0\_2*;

- 4 or 5 bits according to Table 7.3.1.1.2-2A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16=fullpowerMode1,* the values of higher layer parameters *maxRankForDCI-Format0-2=2,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetForDCI-Format0-2*;

- 4 or 6 bits according to Table 7.3.1.1.2-2B for 4 antenna ports, if *txConfig = codebook, ul-FullPowerTransmission-r16=fullpowerMode1,* the values of higher layer parameters *maxRankForDCI-Format0-2=3 or 4,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubsetForDCI-Format0-2*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank-ForDCIFormat0\_2*, and *codebookSubset-ForDCIFormat0\_2*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16=fullpowerMode1*, *maxRankForDCI-Format0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetForDCI-Format0-2*;

- 2 or 4 bits according to Table7.3.1.1.2-4 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank-ForDCIFormat0\_2* and *codebookSubset-ForDCIFormat0\_2*;

- 2 bits according to Table 7.3.1.1.2-4A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16=fullpowerMode1*, transform precoder is disabled, the *maxRankForDCI-Format0-2=2*, and *codebookSubsetForDCI-Format0-2=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank-ForDCIFormat0\_2* and *codebookSubset-ForDCIFormat0\_2*;

- 2 bits according to Table 7.3.1.1.2-5A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission-r16=fullpowerMode1*, *maxRankForDCI-Format0-2=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubsetForDCI-Format0-2*.

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission-r16* is configured to *fullpowerMode2*, the values of higher layer parameters *maxRankForDCI-Format0-2* is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in an SRS resource set with usage set to 'codebook' and an SRS resource with 2 antenna ports is indicated via SRI in the same SRS resource set, then Table 7.3.1.1.2-4 is used.

---------------------------------------End of Text Proposal for TS 38.212------------------------------------------

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| Company | Comments |
| ZTE | We agree with the TPs. |
| Huawei, HiSilicon | Fine to leave editor to handle |
| Intel | Fine with the modification. |
| OPPO | Support |
| LG | Support |
| Apple | OK with the editorial change |
| Spreadtrum | Support |