**3GPP TSG RAN WG1 #101 R1-200xxxx**

**e-Meeting, May 25th – June 5th, 2020**

Source: moderator (vivo)

Title: Outcome of [101-e-NR-eMIMO-ULFPTx-03] Email discussion

Agenda Item: 7.2.6.4

Document for: Discussion and Decision

1. Summary

TP for TS 38.213v16.1.0 section 7.1

Reason for change: in RAN1#100b-e, it was agreed that UE reporting full coherent capability can also report UL full power transmission capability, however in the current spec the description for power scaling only includes the cases of codebook subset in PUSCH-Config set to nonCoherent or partialAndNonCoherent.

Summary of change: the phrase “codebook subset in PUSCH-Config set to nonCoherent or partialAndNonCoherent” is removed in order not to limit the power scaling applicability to other case

Consequences if not approved: power scaling is undefined for an UE reporting full coherent capability and UL full power transmission capability together

Clauses affected: 38.213, section 7.1

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**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 or configured by *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, if *txConfig* in *PUSCH-Config* is set to 'codebook',

- if ULFPTx in PUSCH-Config is provided ~~and codebookSubset in PUSCH-Config is set to nonCoherent or partialAndNonCoherent~~, the UE scales $\hat{P}\_{PUSCH,b,f,c}(i,j,q\_{d},l)$ by $s$ where:

- if ULFPTxModes in PUSCH-Config is set to Mode1, and each SRS resource in the SRS-ResourceSet with usage set to 'codebook' has more than one SRS port', $s$ 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 ULFPTxModes in PUSCH-Config is set to Mode2, $s=1$ for full power TPMIs reported by the UE [16, TS 38.306], and $s$ 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 SRI if more than one SRS resources are configured in the SRS-ResourceSet with usage set to 'codebook', 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', and

- if ULFPTxModes in PUSCH-Config is not provided, $s=1$

- else, if each SRS resource in the SRS-ResourceSet with usage set to 'codebook' has more than one SRS port, the UE scales the linear value by the ratio of the number of antenna ports with a non-zero PUSCH transmission power to the maximum number of SRS ports supported by the UE in one SRS resource.

The UE splits the power equally across the antenna ports on which the UE transmits the PUSCH with non-zero power.

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TP for TS 38.214v16.1.0 section 6.1.1.1

Reason for change: in RAN1#101-e, it was agreed that the UE does not expect to configured with UL full power transmission mode1 and codebook subset of fullAndPartialAndNonCoherent.

Summary of change: the agreement is captured in the spec

Consequences if not approved: the spec doesn’t preclude configuring an UE with UL full power transmission mode1 and codebook subset of fullAndPartialAndNonCoherent

Clauses affected: 38.214, section 6.1.1.1

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#### 6.1.1.1 Codebook based UL transmission

For codebook based transmission, PUSCH can be scheduled by DCI format 0\_0, DCI format 0\_1, DCI format 0\_2 or semi-statically configured to operate according to Clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_1, DCI format 0\_2, or semi-statically configured to operate according to Clause 6.1.2.3, the UE determines its PUSCH transmission precoder based on SRI, TPMI and the transmission rank, where the SRI, TPMI and the transmission rank are given by DCI fields of SRS resource indicator and Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator* and *precodingAndNumberOfLayers* according to clause 6.1.2.3. The *SRS-ResourceSet(s)* applicable for PUSCH scheduled by DCI format 0\_1 and DCI format 0\_2 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModList-ForDCIFormat0\_2* in *SRS-config*, respectively. The TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource selected by the SRI when multiple SRS resources are configured, or if a single SRS resource is configured TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource. The transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to higher layer parameter *nrofSRS-Ports* in SRS-Config, as defined in Clause 6.3.1.5 of [4, TS 38.211]. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. The indicated SRI in slot *n* is associated with the most recent transmission of SRS resource identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI.

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. 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*.*

A UE reporting its UE capability of 'partialAndNonCoherent' transmission shall not expect to be configured by either *codebookSubset* or *codebookSubset-ForDCIFormat0\_2* with 'fullyAndPartialAndNonCoherent*'*.

A UE reporting its UE capability of 'nonCoherent' transmission shall not expect to be configured by either *codebookSubset* or *codebookSubset-ForDCIFormat0\_2* with *'*fullyAndPartialAndNonCoherent*'* or with *'*partialAndNonCoherent'.

A UE shall not expect to be configured with the higher layer parameter *codebookSubset* or the higher layer parameter *codebookSubset-ForDCIFormat0\_2* set to *'*partialAndNonCoherent' when higher layer parameter *nrofSRS-Ports* in an *SRS-ResourceSet* with *usage* set to 'codebook' indicates that the maximum number of the configured SRS antenna ports in the *SRS-ResourceSet* is two.

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 *ULFPTxModes* is set to 'Mode 2', 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* 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 *ULFPTxModes* is set to 'Mode 2', 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 *ULFPTxModes* is set to 'Mode 2',

- 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 (*maxNumberConfiguredSpatialRelations)* can be configured for all SRS resources with usage set to 'codebook'.

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

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