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

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

Source: moderator (vivo)

Title: Feature lead summary on [101-e-NR-eMIMO-ULFPTx-03]

Agenda Item: 7.2.6.4

Document for: Discussion and Decision

1. Introduction

Per guidance from Mr. Chairman, this is to kick-off following email discussion, please provide your views below.

[101-e-NR-eMIMO-ULFPTx-03] Miscellaneous corrections for full power uplink transmission by 5/29 – Rakesh (vivo)

* TP 3-7 under Issue 2, Issue 3 and Issue 4 of the FL summary
1. Remaining issues
	1. Issue 3: on codebook subset restriction
* ***One of the following alternatives is selected on full-coherent codebook subset for Rel-16 UL full power transmission.***
	+ ***Alt 1: full-coherent codebook subset is not supported for mode 0/mode 1/mode 2;***
	+ ***Alt 2: full-coherent codebook subset is supported for mode 0/mode 1/mode 2, with Rel-15 power scaling factor used;***
	+ ***Alt 3: full-coherent codebook subset is supported for mode 0/mode 1/mode 2, with the same power scaling rule as non-/partial-coherent codebook subset, i.e.,***
		- ***For mode 0, the power scaling factor is 1 for all TPMIs;***
		- ***For mode 1, the power scaling factor is the same as Rel-15 scaling factor;***
		- ***For mode 2, the power scaling factor s equals to 1 for full power TPMIs reported by the UE, and s is determined by #non-zero-PUSCH-port divided by #SRS-ports in the SRS resource indicated by SRI for remaining TPMIs .***
	+ ***Alt 4: full-coherent codebook subset is not supported by mode 1; full-coherent codebook subset is supported by mode 0 and mode 2, with the same power scaling rule as non-/partial-coherent codebook subset for mode 0 and mode 2, i.e.,***
		- ***For mode 0, the power scaling factor is 1 for all TPMIs;***
		- ***For mode 2, the power scaling factor s equals to 1 for full power TPMIs reported by the UE, and s is determined by #non-zero-PUSCH-port divided by #SRS-ports in the SRS resource indicated by SRI for remaining TPMIs .***

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* 1. Issue 2 : TPs for correction on power scaling

TP#3

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

- $s=1$ 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 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 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',

- $s=1$, 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 if only one SRS resource with a single port is provided in the *SRS-ResourceSet* with *usage* set to 'codebook', and

- if *ul-FullPowerTransmission* in PUSCH-Config is set to *fullpower*, $s=1$

- if *ul-FullPowerTransmission* in *PUSCH-Config* is provided and set to *fullpower* or *fullpowerMode2*, and *codebookSubset* in *PUSCH-Config* is set to 'fullAndPartialAndNonCoherent', the UE scales $\hat{P}\_{PUSCH,b,f,c}(i,j,q\_{d},l)$ by $s$ where:

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

- $s=1$ 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 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 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',

- $s=1$, 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 if only one SRS resource with a single port is provided in the *SRS-ResourceSet* with *usage* set to 'codebook', and

- if *ul-FullPowerTransmission* in PUSCH-Config is set to *fullpower*, $s=1$

- 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.

TP#4

- if *ul-FullPowerTransmission* 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 *ul-FullPowerTransmission* in *PUSCH-Config* is set to *fullpowerMode1*, and *codebookSubset* in *PUSCH-Config* is set to 'nonCoherent' or 'partialAndNonCoherent', 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

TP#5

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

TP#6

if *ul-FullPowerTransmission* 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:

TP#7

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

- if ul-FullPowerTransmission in PUSCH-Config is set to fullpowerMode2

- $s=1$ for full power TPMIs reported by the UE [16, TS 38.306],

- $s=1$, if an 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 if only one SRS resource with a single port is provided in the SRS-ResourceSet with usage set to 'codebook', and

- if ul-FullPowerTransmission in PUSCH-Config is set to fullpower, $s=1$

- 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.

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* 1. Issue 4: on SRS resource configuration in Mode2

38.214

\*\*\* Unchanged text is omitted \*\*\*

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* is set to '*fullpowerMode2*' and *codebookSubset* in *PUSCH-Config* is not set to ' *fullyAndPartialAndNonCoherent* ', 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.

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 $\left\{\tilde{p}\_{0},…,\tilde{p}\_{v-1}\right\}$ 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* is set to ' *fullpowerMode2*' and *codebookSubset* in *PUSCH-Config* is not set to ' *fullyAndPartialAndNonCoherent* ', 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* is set to ' *fullpowerMode2*' and *codebookSubset* in *PUSCH-Config* is set to *'nonCoherent'* or *'partialAndNonCoherent'*,

- 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’

\*\*\* Unchanged text is omitted \*\*\*

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# References

[1] R1-2003402, “Feature lead summary on ULFPTx”, vivo, RAN1#101-e