**3GPP TSG RAN WG1 #100bis R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

Source: moderator (vivo)

Title: Feature lead summary on ULFPTx-02

Agenda Item: 7.2.6.4

Document for: Discussion and Decision

1. Introduction

Following email thread is assigned for discussion:

[100b-e-NR-eMIMO-ULFPTx-02] Email discussion on Issue #3 in R1-2002746: UE feature/capability related issues. By 4/24 and corresponding TP (if any) by 4/30– Rakesh (vivo)

1. Discussion on issue 3[1]
	1. Issue 3: UE feature/capability related issues
		1. TP on applicability of Rel-16 UL full power TX and codebooksubset

**TS 38.214**

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6.1.1.1 Codebook based UL transmission

<Omitted>

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.

A UE reporting its UE capability of ''fullyAndPartialAndNonCoherent' transmission shall not expect to be configured with *ULFPTx or ULFPTxModes*.

A UE can be configured to operate in either Mode 1 or Mode 2 upon reception of the higher layer parameters *ULFPTx=’enabled’* and *ULFPTxModes*.

<Omitted>

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**TS 38.213**

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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 the UE reports its UE capability as 'nonCoherent' or 'partialAndNonCoherent' ~~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:

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Please provide your views/comments in the table below

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| --- | --- |
| Company/organization | comments |
| OPPO | we have some comments on the above TPs1. TP should be updated to align with TS 38.331

ul-FullPowerTransmission-r16 ENUMERATED {fullpower, fullpowerMode1, fullpoweMode2} OPTIONAL -- Need R1. If TP for TS 38.214 is approved, the TP for TS 38.213 is not needed since full coherent UE cannot be configured with “ul-FullPowerTransmission-r16”
2. The TP does not use the latest version v16.1.0

Thus we suggest to revise the TP for TS 38.214 as follows (and TP for TS 38.213 is not needed)**TS 38.214**---------------------------------------------------------------------------------6.1.1.1 Codebook based UL transmission<Omitted>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.A UE reporting its UE capability of ''fullyAndPartialAndNonCoherent' transmission shall not expect to be configured with *~~ULFPTx or ULFPTxModes~~* *ul-FullPowerTransmission-r16* When higher layer parameter *ULFPTxModes* is set to 'Mode 2', <Omitted>--------------------------------------------------------------------------------- |
| Samsung | Support this TP (also OK with OPPO’s revision) due to the following agreement stating that “full power UL transmission is supported for non-coherent and partial/non-coherent capable UEs” being either not captured or captured incorrectly.

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| **RAN1#95****Agreement**Full TX power UL transmission with multiple power amplifier is supported at least for codebook based UL transmission for non-coherent and partial/non-coherent capable UEs* This specification support is a UE optional feature
* FFS: Whether this applies for the entire codebook or subset of codebook
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| CATT | Do not support. There is no RAN1 agreement that a full-coherent UE does not support mode 0/1/2. Coherent capability and full-power capability address different aspects of UE implementation and they are not mutually exclusive. A UE capable of and intending to support both full-coherent transmission and mode 0/1/2 shall not be precluded. For instance a full-coherent 4Tx UE can still benefit from 2Tx full-power transmission with 2 SRS. This implementation should be allowed. It can be optional, as is the case now. In summary the current specification is not broken and requires no update.  |
| Apple | Do not support. For example, for UE with full-rate PA. We do not understand why we treat coherent UE differently from the non-coherent or partial coherent UE, meaning whether we allow antenna selection TPMI to transmit at full power. Even though coherent UE can use coherent TPMI to achieve full power, however the UE performance is different between coherent TPMI and antenna selection TPMIUsing 2 PA coherent UE as example, if one of the antennas is blocked especially the secondary antenna, using coherent rank 1 TPMI will not improve coverage, while on the contrary, it just increases the UE power consumption. On the other side, Rel-15 power saving does not allow antenna selection TPMI to transmit at full power which potentially makes the coherent UE performs worse than non-coherent UE.  |
| Huawei, HiSilicon | Do NOT support.Full agree with CATT and Apple. The TPs were discussed many rounds, it is not essential and does not make sense. From technique, from Rel-15, the UE with full coherent capability, it is also can be configured with non-coherent or partial coherent codebook subsets, which is beneficial for blockage (partial antenna(s)) scenarios with antenna selection pre-coders. For full power transmission, if one or two antennas are blocked for UL transmission, the full power can be transmitted from other remaining antennas. However, with the restriction on the proposed TPs, half power will always be wasted. Please note that for UL transmission, hand-shadowing (blockage for parts of antennas) is not a corner case.From specs and agreements, there is no agreement to preclude full-coherent UE to full power transmission. Even with Samsung mentioned agreement, it is clear say “at least”. And this agreement is replaced by late approved TS 38.213 and TS 38.214. Please note that the approved spec is also an updated agreement. |
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* + 1. Additional UE capability signaling, e.g. mode0, mode1, mode2, TPMI in mode2
		- Topic 1: new UL codebook set(s) when the UE reports mode1 as its capability
		- Topic 2: TPMI group signalling when the UE reports mode2 as its capability
		- Topic 3: Separate capability signalling for mode0, mode1, and mode2
		- Topic 4: Multiple modes signalling is *not supported*, e.g., mode1AndMode2

Please provide your views/comments in the table below

|  |  |
| --- | --- |
| Company/organization | comments |
| OPPO | Topic 1: not neededTopic 2: okTopic 4: Not support signaling of multiple modes for a UE |
| Samsung | Topic 1: not neededTopic 2: not needed (If TPMI group signaling is optional (hence, may not be provided by a UE) and the UE reports mode2 as its capability, then the UE has to be configured with multiple SRS resources with different number of SRS ports in order to achieve full power, which has more SRS resource overhead when compared with a solution which works with a single SRS resource.) Topic 3: since mode0-2 correspond to 3 different solutions, UE capability should be separate for the threeTopic 4: Not support signaling of multiple modes for a UE (Since a UE will most likely implement only one of the 3 modes in practice, a UE supporting multiple modes is not meaningful and lack use case in real UE implementations) |
|  |  |
| Apple | Topic 1: not neededTopic 2: supportTopic 3: supportTopic 4: Open for discussion |
| Huawei, HiSilicon | For each items, our view is also listed as follows:Topic 1: Not needed, since only one codebook subset for Mode-1. If Mode-1 is supported, the unique codebook subset is supported.Topic 2: Supportive. There are multiple TPMI groups agreed, e.g., G0~G6. Which TPMI groups is supported for the UE should be reported by UE. The UE reporting on TPMI group for full power transmission is also an agreement. Furthermore, **One** or more SRS resources can be configured for Mode-2, not only multiple resources always.Topic 3: Only Mode-1 and Mode-2 is needed, and fine to split. There is no definition on Mode-0.Topic 4: Supportive, and optional for the feature. If UE have the capability to support Mode-1 and Mode-2, it should allow UE to report and also allow NW to freely select the best mode based on the scenarios or situation. For example, if both both mode-1 and 2 are supported by UE, in the case of blockage, Mode-2 will be selected, and Model-1 will be used for low non-blockage case. |
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# References

[1] R1-2002746, Summary of prep email discussion on ULFPTx, RAN1#100b-e