**3GPP TSG RAN WG2 Meeting #109-e TD R2-2002353**

**Electronic meeting, 24th February – 6th March, 2020.**

Title: [DRAFT] Reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43)

Response to: LS (R2-1916482) on Discussion over UE capabilities of FG2-36/2-40/2-41/2-43 from RAN1

Release: Release 16

Work Item: TEI16, NR\_newRAT-Core

Source: NTT DOCOMO, INC. (to be RAN2)

To: RAN1

Cc:

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Attachments:

**1. Overall Description:**

RAN2 would like to thank RAN1 for their LS on CSI-RS capabilities (FG 2-33/36/40/41/43). From the background mentioned in the LS, RAN2 understand the following two problems:

**Problem 1**: Limitation of active CSI-RS ports/resources in a slot;

The triplet included in *SupportedCSI-RS-Resource* is defined pre frequency band outside the band combination signalling. As such, the supported value may not be scaled up in case of inter-band CA.

**Problem 2:** Lack of overall capabilities per codebook type.

For FG-2-33, the maximum number of simultaneous CSI-RS resources and total number of CSI-RS ports in active BWPs across all CCs are common to all codebook types and so the UE may have to report the conservative values supported for all codebook types.

Given that the signalling details are left to RAN2 decision, RAN2 is working on the following solution direction to address the problems as well as balancing the signalling overhead.

Solution addressing Problem 1:

* **For each band and for each codebook type** the UE may report an additional SupportedCSI-RS-Resource (“triplet”). While the UE indicates the supported number of **simultaneously** **active** resources in the existing list of triplets, it indicates the **RRC-configurable** resources in the new field. The UE might be able to report higher values in the new field than in the legacy field (for the TDM case, as mentioned in the RAN1 LS).

Solution addressing Problem 2:

* In addition to the existing “maxNumberSimultaneousNZP-CSI-RS-ActBWP-AllCC” and “totalNumberPortsSimultaneousNZP-CSI-RS-ActBWP-AllCC” (given per BC), the UE may advertise **for each BC and for each codebook type** the “maxNumberResources-r16” and the “totalNumberTxPorts-r16” (across all carriers in the BC). There is no consensus on whether to also introduce maxNumberTxPortsPerResource in the new per BC signaling.

To make progress the solution details for further, RAN2 observed the following questions.

Q1: Definition of CSI-RS ports/resources configured for the TDM case.

RAN2 understand that the legacy triplet included in SupportedCSI-RS-Resource is relevant to the following definition in sub-clause 5.2.1.6 of TS 38.214.

*In any slot, the UE is not expected to have more active CSI-RS ports or active CSI-RS resources than reported as capability.*

RAN2 is wondering if the current running CR to 38.306 describing “active Tx ports/resources across multiple slots” by referring to sub-clause 5.2.1.6 of TS 38.214 is in line with RAN1’s understanding.

Q2: The maximum value of simultaneous CSI-RS resources and CSI-RS ports.

In the existing SupportedCSI-RS-Resource, the maximum value of simultaneous resources is 64 and the one of total Tx ports is 256. RAN2 is wondering if the existing value is enough to address the total capability across all CCs or the larger value is desirable.

Q3: indication of maxNumberTxPortsPerResource in a per BC manner

In the RAN1 LS it is stated that “To address above issue, RAN1 has agreed to recommend to introduce new per band capability signaling and per BC capability signaling for component 1 of FG2-36/2-40/2-41/2-43”. The component 1 of FG2-36/2-40/2-41/2-43 contains maxNumberTxPortsPerResource. Currently RAN2 had no consensus to whether to introduce maxNumberTxPortsPerResource per BC. Without this additional field, the number of ports for each resource would be determined based on the values indicated for the band on which the resource is configured, like in Rel-15 signaling (given in the existing per-band signaling). See Annex A for an example. RAN2 would appreciate if RAN1 could provide feedback if this structure does not serve the intended purpose.

**2. Actions:**

**To RAN1.**

**ACTION:** RAN2 respectfully asks RAN1 to answer to the above questions. It is noted that RAN2 agreed to extend the signalling as TEI16. RAN2 would appreciate if RAN2 could receive the feedback until the completion of Rel-16.

**3. Date of Next RAN2 Meetings:**

RAN2 Meeting #109bis 20th – 24th April 2020 Sapporo, Japan.

RAN2 Meeting #110 25th – 29th May 2020 Athens, Greece.

**Annex A**

BandNR:

**Band A**: [

    maxNumberTx**PortsPerResource** = 2

    maxNumber**ResourcesPerBand** = 8

    totalNumberTx**PortsPerBand** = 16

  ]

**Band B**: [

    maxNumberTxPortsPerResource = 4

    maxNumberResourcesPerBand = 8

    totalNumberTxPortsPerBand = 32

  ], [

    maxNumberTx**PortsPerResource** = 8

    maxNumber**ResourcesPerBand** = 4

    totalNumberTx**PortsPerBand** = 32

  ], [

maxNumberTxPortsPerResource = 16

    maxNumberResourcesPerBand = 2

    totalNumberTxPortsPerBand = 32

  ]

**BandCombination: A+B** [

    maxNumber**ResourcesPerBC** = 8

    totalNumberTx**PortsPerBC** = 32

  ]

When the NW configures a cell on Band A and one on Band B, it could e.g. configure...

Band A: 5 resource with 2 ports each (i.e., 10 ports in total on this band) (allowed by bold Band A entry)

Band B: 2 resource with 8 ports each (i.e., 16 ports in total on this band) (allowed by bold Band B entry)

The resulting configuration would hence have (5+2=)7 resources and (10+16=)16 ports in total (allowed by A+B entry) – this would be allowed according to maxNumberResourcesPerBC and totalNumberTxPortsPerBC .

Some companies think that in addition to maxNumberResourcesPerBC and totalNumberTxPortsPerBC, the max ports per resource is also limited for a BC (maxNumberTxPortsPerResource), for instance 4 ports per resource in the above example of A + B. That means when configured according to A+B, no resource shall have more than 4 ports per resource. The resulting configuration would hence only have 4 ports per resource.