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

**e-Meeting, April 20th –30th, 2020**

**Source: Moderator (NTT DOCOMO)**

**Title: Summary of LS on CSI-RS capabilities (FG 2-33/36/40/41/43)**

**Agenda item: 5**

**Document for:** **Discussion/Decision**

# Introduction

During RAN2#109e, an LS on CSI-RS capabilities (FG 2-33/36/40/41/43) was sent to RAN1 [1]. In this LS, RAN2 asked RAN1 to 3 questions for enhancement of CSI-RS capabilities (FG 2-33/36/40/41/43).

Per chairman’s guidance, this summary is to collect companies’ views on this LS and try to draft the reply based on companies’ input.

[100b-e-LS-07] Email approval of the reply LS for [R1-2001519](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2001519.zip) by 4/24 (DCM, Yuki)

# Discussion

## Answer to Q1

In Q1, RAN2 asked whether to define UE capability of “active Tx ports/resources across multiple slots”.

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| 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. |

In sub-clause 5.2.1.6 of TS 38.214, counting rule of the number of active CSI-RS is specified, and it is clear that the UE is not expected to have more active CSI-RS ports/resources than reported as UE capability in any slot:

*In any slot, the UE is not expected to have more active CSI-RS ports or active CSI-RS resources than reported as capability. NZP CSI-RS resource is active in a duration of time defined as follows. For aperiodic CSI-RS, starting from the end of the PDCCH containing the request and ending at the end of the PUSCH containing the report associated with this aperiodic CSI-RS. For semi-persistent CSI-RS, starting from the end of when the activation command is applied, and ending at the end of when the deactivation command is applied. For periodic CSI-RS, starting when the periodic CSI-RS is configured by higher layer signalling, and ending when the periodic CSI-RS configuration is released. If a CSI-RS resource is referred by N CSI reporting settings, the CSI-RS resource and the CSI-RS ports within the CSI-RS resource are counted N times.*

However, it is not clear why we should define UE capability of “active Tx ports/resources across multiple slots.

Companies’ views are summarized as below (based on tdocs and input in R1-2002736):

* + Q1: whether “active Tx ports/resources across multiple slots” should be reported?
		- No (“per slot” reporting is enough): ZTE, vivo, DOCOMO, OPPO
		- Yes: Intel(?), Samsung
		- Question from Huawei/HiSilicon (what are definitions of the starting slot and the ending slot of “multiple slots”)
		- Comment from Nokia: Suggest clarifying the specific RAN2 CR referred to in Q1 so that RAN1 can give a consistent answer

From moderator perspective, it is assumed that the Q1 comes from different understanding the under reporting issue between RAN1 and RAN2, and defining “active Tx ports/resources across multiple slots” does not help to solve the under reporting issue.

**Discussion point 1: do you see any necessity of defining UE capability of “active Tx ports/resources across multiple slots”?**

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| Company | Comments |
| DOCOMO | No, current reporting of “active Tx ports/resources per a slot” is enough. |
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## Answer to Q2

In Q2, RAN2 asked whether the current maximum value of simultaneous CSI-RS resources and CSI-RS ports are enough.

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| 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. |

Based on tdocs and input in R1-2002736, no companies raised necessity of changing the maximum values.

* + Whether the current maximum value of simultaneous CSI-RS resources and CSI-RS ports are enough?
		- Yes: ZTE, vivo, Intel, Samsung, DOCOMO, Qualcomm, Huawei/HiSilicon, OPPO, LGE

From moderator perspective, it is assumed that the answer to Q2 is stable. If you have different understanding, please comment it.

**Discussion point 2: Do you think the current maximum value of simultaneous CSI-RS resources and CSI-RS ports are enough?**

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| Company | Comments |
| DOCOMO | Yes, RAN1 has no intention to increase the maximum value of simultaneous CSI-RS resources and CSI-RS ports. |
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## Answer to Q3

In Q3, RAN2 asked whether to report maxNumberTxPortsPerResource in a per BC.

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| 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. |

Companies’ views are following (based on tdocs and input in R1-2002736).

* + Q3: whether to report *maxNumberTxPortsPerResource* per BC?
		- Yes: ZTE, Intel, Qualcomm, Huawei/HiSilicon, OPPO
		- No: vivo, Samsung, DOCOMO, LGE

**Discussion point 3: Do you think maxNumberTxPortsPerResource should be reported per BC?**

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| Company | Comments |
| DOCOMO | No, we think maxNumberTxPortsPerResource per BC is not needed, because it corresponds to the max. number of CSI-RS ports of one CSI-RS resource, and it is reported per each band. |
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## Others

Some companies mentioned that current FG 2-33 per BC cannot avoid the under reporting issue, and they propose reporting per BC of enhanced FG2-33 (reporting multiple combination of FG2-33), or enhanced triplet (reporting the triplet per BC).

**Discussion point 4: Do you think the current FG2-33 (i.e. single combination of {maxNumberResourcesPerBC, totalNumberTxPortsPerBC} per BC) has an issue of under reporting, and should we inform it to RAN2?**

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| Company | Comments |
| DOCOMO | Yes, the example is shown in our contribution (R1-2002427) |
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**Discussion point 5: If the answer of discussion point 4 is yes, do you think we should show the possible enhancement of current signalling?**

[Moderator] So far, following two examples are proposed:

* + - Opt. 1) Enhancement of FG2-33 to enable reporting multiple combinations of max. number of CSI-RS resources and CSI-RS ports per BC per each CSI codebook type
		- Opt.2) A list of supported combinations for each codebook, whereas each combination is a triplet of {maxNumberTxPortsPerResource, maxNumberResources, totalNumberTxPorts}, shall be signaled to gNB with a granularity of per BC

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| Company | Comments |
| DOCOMO | Yes, and we prefer option1.But, we suggest to discuss this after the answer to Q3 becomes stable.  |
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In addition to the above questions, do you figure out any other potential issues? If yes, please provide your detailed comments in the below table.

**Discussion point 6: Any other issue (if any)?**

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| Company | Comments |
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# Conclusion

To be updated

# Reference

1. R1-2001519, Reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43), RAN2#109e.
2. R1-2001590 Draft reply LS on UE capabilities of CSI-RS ZTE
3. R1-2001901 Draft reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43) vivo
4. R1-2001980 Draft reply LS on CSI-RS capabilities Intel Corporation
5. R1-2002100 Draft reply to RAN2 LS on CSI-RS capabilities (FG 2-33/36/40/41/43) Samsung
6. R1-2002427 [Draft] Reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43) NTT DOCOMO, INC
7. R1-2002514 Draft response to Reply LS on CSI-RS capabilities Qualcomm Incorporated
8. R1-2002673 Discussion on Reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43) Huawei, HiSilicon
9. R1-2002681 [Draft] Reply LS on CSI-RS capabilities (FG 2-33/36/40/41/43) Huawei, HiSilicon