**3GPP TSG RAN WG1 Meeting #102-e R1-200xxxx**

**e-Meeting, August 17th – 28th, 2020**

**Agenda item:** 5

**Source:** Moderator (Samsung)

**Title:** Summary of reply LS on Detail MIMO MAC CE Operations

**Document for:** Discussion and Decision

1. Introduction

RAN1 received an LS from RAN2 on details of MIMO MAC CE operations [1]. In [1], RAN2 asked three questions regarding TCI state activation and SRS spatial relation. As guided by the chairman, this summary is to collect companies’ inputs on the questions in the LS and draft the reply based on the inputs.

[102-e-LS-AI5-02] Email discussion/approval of reply LS for [R1-2005203](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005203.zip) by 08/21 (TBD, Samsung)

2. Answer to Question 1

The first question from RAN2 is as follows.

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| **Question 1:** Could RAN1 specify how the TCI state codepoints are mapped when the number of codepoints in the TCI field of DCI format 1\_2 is less than the maximum number of codepoints in the TCI field of DCI format 1\_1 taking into account that the MAC CE may signal TCI states corresponding to maximum amount of DCI codepoints.? |

From the draft replies submitted in RAN1#102-e, all the companies have the common understanding that the first *K* TCI states activated by MAC-CE are mapped to the *K* codepoints in DCI format 1\_2, and such mapping is specified in TS38.321. On the necessity of additionally specifying such mapping in RAN1, the views are summarized as:

* Yes (okay to specify): Huawei, ZTE, FUTUREWEI, Ericsson, MediaTek, Nokia
* No (no need to specify): vivo, CATT, Samsung, LGE

Based on the majority inputs so far, moderator’s initial proposal for the answer is:

**Proposal 1. There is no need to specify the mapping for TCI codepoints in DCI format 1\_2 in RAN1.**

Please provide comments on the proposal below:

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| --- | --- |
| Company | Comments |
| vivo | Supports the FL proposal. |
| Apple | Support the FL proposal |
| Huawei | We prefer to make it clearer in RAN1 spec since RAN1 agreement is already there. Based on LS, RAN2 cannot find corresponding explanations for the mapping of TCI codepoints for DCI format 1\_2. |
| Samsung | Supports the FL proposal. |
| Intel | Agree with FL proposal |
| ZTE | We share the same views with Huawei that the reason of sending the LS from RAN2 is due to that the current RAN1 spec is unclear, and consequently benefits of specifying the mapping can be observed clearly. |
| FUTUREWEI | Agree with ZTE and Huawei on clarify in RAN1 spec. |
| Ericsson | We share similar views as Huawei and ZTE.  Note that in RAN2’s incoming LS, RAN2 wrote the following as this restriction is not specified in 38.321:  “RAN2 believes that some restrictions on TCI states codepoints mapping when the number of codepoints in the TCI field of DCI format 1\_2 is less than the maximum number of codepoints in the TCI field of DCI format 1\_1 can be clarified in RAN1 specifications.”  Note that 38.321 does not say anything about the case when the number of codepoints in the TCI field of DCI format 1\_2 is less than the maximum number of codepoints in the TCI field of DCI format 1\_1.  So we prefer to specify this restriction in RAN1 specs. |
| MediaTek | We also share the same views as Huawei, ZTE, FUTUREWEI, and Ericsson. As RAN2 recommended, it is better to specify the clear mapping rule for DCI format 1\_2 in RAN1 spec. |
| Lenovo, Motorola Mobility | Supports the FL proposal. |
| Spreadtrum | Share the same view with Huawei, ZTE, FUTUREWEI, Ericsson, and MTK. We prefer to specify this mapping rule in RAN1 spec. |
| OPPO | We prefer to clarify in RAN1 spec. |
| DOCOMO | We prefer to clarify it in RAN1 spec. |
| CATT | Support the FL proposal. |
| Nokia | RAN1 specification would be good. |
| LG | Support the FL proposal. |
| Qualcomm | Support FL’s proposal |

3. Answer to Question 2

The second question from RAN2 is as follows.

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| **Question 2:** Is RAN2 understanding correct that the intended functionality of the Serving cell set based SRS spatial relation indication MAC CE is to only indicate the SRS spatial relations for SRS resource(s) which are applied for all configured serving cell set? (i.e. no need to activate/deactivate transmission of SRS resources(s) for all configured cells in the serving cell set) |

From the draft replies submitted in RAN1#102-e, it is observed that all the companies have the same understanding with RAN2.

Based on the majority inputs so far, moderator’s initial proposal for the answer is:

**Proposal 2. RAN1 has the same understanding with RAN2.**

Please provide comments on the proposal below:

|  |  |
| --- | --- |
| Company | Comments |
| vivo | Supports the FL proposal |
| Apple | Support the FL proposal |
| Huawei | Agree with Proposal 2 |
| Samsung | Supports the FL proposal. |
| Intel | Agree with FL proposal |
| ZTE | Not support.  For semi-persistent SRS, the motivation of introducing the Serving cell set based SRS spatial relation indication MAC CE is to fully replace the legacy MAC-CE for activating semi-persistent SRS per CC, i.e., simultaneously updating spatial relation as well as activating/deactivating semi-persistent SRS in the set of multiple CC/BWPs. If not including activating or deactivating functions, the gNB still has to send multiple independent MAC-CE commands of activating the SRS resource for each CC. The overhead is still high. |
| FUTUREWEI | Support the FL proposal 2 |
| Ericsson | Support the FL proposal |
| MediaTek | Support the FL proposal |
| Lenovo, Motorola Mobility | Supports the FL proposal. |
| Spreadtrum | Support the FL proposal |
| OPPO | Support the FL proposal |
| DOCOMO | Support the FL proposal |
| CATT | Support the FL proposal. |
| Nokia | Support the FL proposal. |
| LG | Support the FL proposal. |
| Qualcomm | Support FL’s proposal |

Summary of inputs

* The MAC-CE is for activating/deactivating SP-SRS: 1 company
* The MAC-CE is not for activating/deactivating SP-SRS: 15 companies

4. Answer to Question 3

The third question from RAN2 is as follows.

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| **Question 3:** Is RAN2 understanding correct that the Serving cell set based SRS spatial relation indication MAC CE can be used to indicate the SRS spatial relations in SUL configuration? |

From the draft replies submitted in RAN1#102-e, the views on the question are summarized as follows.

* Yes (the MAC-CE can be used for SUL): CATT, Lenovo/MotM, Samsung, LGE, Ericsson, Huawei, MediaTek
* No (the MAC-CE cannot be used for SUL): vivo, ZTE, OPPO

The companies saying ‘yes’ claim that RAN1 haven’t excluded this MAC-CE for SUL. While the companies saying ‘no’ claim that gNB doesn’t need to configure SRS spatial relation for SUL which is FR1 carrier.

Based on the majority inputs so far, moderator’s initial proposal for the answer is:

**Proposal 3. RAN1 understands that the MAC-CE can be used with SUL.**

Please provide comments on the proposal below:

|  |  |
| --- | --- |
| Company | Comments |
| vivo | The behavior has not been discussed in RAN1 previously. The MAC CE is not applicable for cells with SUL configured. |
| Apple | Spatial relation is only applicable for FR2 band. So it cannot be used for SUL. |
| Huawei | Agree with Proposal 3. |
| Samsung | Supports the FL proposal. RAN1 hasn’t excluded configuring spatial relation in FR1. |
| Intel | We have similar view to Apple that SUL in RAN4 are limited to FR1 bands, but spatial relation is applicable to FR2. We are not sure on spec additional impact if spatial relation would be allowed in FR1 as well. The proponents of FL proposal should clarify this first. |
| ZTE | We share the same views with Apple and Intel that the spatial relation is only applied to FR2 (one reference, i.e., UE capability of spatial relation, is copied herein), but SUL is only in FR1. Consequently, the MAC-CE for updating spatial relation should NOT be applied for SUL.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2-59 | Configured spatial relations | Maximum number of configured spatial relations per CC for PUCCH and SRS |  | Yes | Only one configured spatial relation for UL signals can be supported | Type 1 | N.A. | N.A. |  | Note: Only applicable for FR2 | |
| FUTUREWEI | Agree with FL Proposal 3. From RAN1 perspective, there is no limitation to the applicability to SUL. |
| Ericsson | Support the FL proposal: fundamentally, we do not see any issue in supporting this also for SUL. |
| MediaTek | Support the FL proposal |
| Lenovo, Motorola Mobility | Supports the FL proposal. |
| Spreadtrum | Support the FL proposal. At present, RAN1 has not excluded its applicability to SUL. |
| OPPO | Share the same view as Apple, Intel, ZTE. All the SUL bands in frequency range 1, and spatial relations are not applicable for frequency range 1 |
| DOCOMO | Support the FL proposal. There is no need to preclude SUL from RAN1 perspective. |
| CATT | Support the FL proposal. RAN1 agreement doesn’t differentiate the carrier type (NUL vs. SUL). To exclude SUL would need new RAN1 agreement. |
| Nokia | We do not see the applicability of spatial relation in FR1, hence even if there is no explicit agreement on SUL, the issue is not applicable! |
| LG | Support the FL proposal. |
| Qualcomm | Not support FL’s proposal. Because spatial relation is only applicable to FR2 as described in spec. Also, SUL is only defined for FR1 in RAN4 spec.  ***spatialRelations***  Indicates whether the UE supports spatial relations. The capability signalling comprises the following parameters.  - *maxNumberConfiguredSpatialRelations* indicates the maximum number of configured spatial relations per CC for PUCCH and SRS. It is not applicable to FR1 and applicable to FR2 only. The UE is mandated to report 16 or higher values;  - *maxNumberActiveSpatialRelations* indicates the maximum number of active spatial relations with regarding to PUCCH and SRS for PUSCH, per BWP per CC. It is not applicable to FR1 and applicable and mandatory to report one or higher value for FR2 only;  - *additionalActiveSpatialRelationPUCCH* indicates support of one additional active spatial relation for PUCCH. It is mandatory with capability signalling if *maxNumberActiveSpatialRelations* is set to n1;  - *maxNumberDL-RS-QCL-TypeD* indicates the maximum number of downlink RS resources used for QCL type D in the active TCI states and active spatial relation information, which is optional.  The UE is mandated to report *spatialRelations* for FR2. |

Summary of inputs

* Yes (the MAC-CE is applicable for SUL): 10 companies
* RAN1 has not explicitly precluded the MAC-CE from being configured for SUL
* No (the MAC-CE should not be applied for SUL): 6 companies
* Configuring SRS spatial relation is not applicable for FR1 carrier

5. Conclusion

Based on the inputs so far, moderator has made the following conclusions.

**Answer to Question 1:**

RAN1 understands when the number of TCI states activated by MAC-CE is larger than the number of codepoints, say *K*, in DCI format 1\_2, the first *K* activated TCI states are ordinally mapped to each of DCI codepoints. RAN1 has no consensus on whether it is needed to specify such mapping or not in RAN1 specification.

**Answer to Question 2:**

Yes, RAN1 has the same understanding with RAN2 that intention of the MAC-CE is to only indicate SRS spatial relations.

**Answer to Question 3:**

RAN1 has not precluded the MAC-CE from being configured for SUL. However, RAN1 has no consensus on whether applying SRS spatial relations to SUL is valid or not.

## References

1. R1-2005203, LS on Detail MIMO MAC-CE operations, RAN2