**3GPP TSG RAN WG1 #101 R1-2004713**

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

**Agenda item:** 7.2.6.1

**Source:** Moderator (Samsung)

**Title:** Feature lead summary for MU-MIMO CSI thread #2

**Document for:** Discussion and Decision

1. Introduction

Based on the discussion during the preparation phase summarized in [1] and the Phase-2 instruction from the MIMO chairman, the following issue is to be discussed in thread #2 for MU CSI:

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| *Discuss the following issue:*   1. *Examine when the UE reports useless information (bitmap and reference amplitude are reported even if LCC is absent) for 3 out of 8 supported parameter combinations and whether this optimization is significantly beneficial and should be addressed by specification* 2. *If so, modify the definition of to ensure that a UE can report one NZC per polarization for rank . Two alternatives to be discussed are:*    1. *Alt 1:*    2. *Alt 2:* 3. *Possible conclusion*    1. *There is no consensus in supporting the proposals in N.1, N.2, N.3, N.4-1a/2a/2b, N.5, N.6, and N.7 as summarized in Table 2 [of [1]]* |

Issue 3 (“possible conclusion”) has been discussed at length in Phase-1 and the content has been agreeable to the group. Therefore, the group is to focus on issues 1 and 2 which are pertinent to N.4-1b.

It is quite apparent that issue 1 and 2 are inter-dependent. Whether issue 2 needs to be discussed depends on whether the problem raised in issue 1 requires spec-based solution(s). Conversely, the need for spec-based solution(s) in issue 1 should be based on the assessment of the two alternatives given in issue 2 (Alt1 and Alt2 for the value of *x*) since only such alternatives are to be considered if a spec-based solution is to be adopted. Therefore, issue 1 and 2 cannot be decoupled and should be decided jointly.

In addition, given that proposal N.4-1b is non-essential and an optimization, more stringent assessment based on a properly identified core issue should be made. In this case, the core issue is precisely *the absence of LCC with the presence of bitmap and reference amplitude in an instant of eType-II CSI reporting*. To assess the seriousness of this core issue, each interested company is encouraged to:

1. state the scenarios in which the core issue occurs,
2. assess the importance of each of those scenarios,
3. assess the benefit of the two alternatives, and
4. state whether a spec-based solution is justified and, if so, which one
5. Summary

Interested companies are to provide their abridged views in the following table.

Table 1 Abridged views

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| **Company** | **Position** | | |
| **Spec-based solution not needed** | **Spec-based solution needed: Alt 1** | **Spec-based solution needed: Alt 2** |
| Samsung | Yes |  |  |
| Apple | Slightly prefer not to change |  |  |
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In the table below, interested companies are to provide more detailed views based on the four points in section 1.

Table 2 More detailed views

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| **Company** | **Comment** |
| Samsung | 1. The issue exists with small #SBs (e.g. 3,4), which however is not a target use case of eT2.    1. The main use case of eT2 is MU-MIMO with frequency-selective MU scheduling – which requires sufficiently large number of SBs. 2. Optimization of a corner case    1. Optimization since the current spec is not broken, and the proposal (Alt 1 and Alt 2) targets performance improvement (when compared with Type I CSI)    2. Corner case (cf. point 1. above) since the probability of being configured with small #SBs for MU-MIMO is extremely small. 3. The issue is only with certain value(s) of ParamCombination-r16 (e.g. 1). The gNB however is free to configure other ParamCombination-r16 values (e.g. 2). Hence, there is already spec-support to avoid this.    1. Note: a larger ParamCombination-r16 value implies a larger K0 value. And Alt 1 and Alt 2 essentially propose to increase K0 value. But, the same (a large K0 value) can be achieve by configuring a large ParamCombination-r16 value. 4. If the concern is performance loss when compared with Type I, then gNB is free to configure Type I codebook (or R15 T2 CB). Note that a small K0 value (e.g. K0=1) implies lower-resolution, hence such a codebook is any way closer to Type I. If K0 is too small (e.g. 1), the gNB might as well configure Type I. 5. Regarding higher rank (e.g. rank 3-4), if gNB allows (expects) higher rank CSI, then it should configure reasonable/appropriate value for codebook parameters (such as ParamCombination-r16 and number of SBs). It is strange to configure ParamCombination-r16=1 and small #SBs, and expect a UE to report high rank CSI. In our view, there is no technical motivation behind such weird configurations. |
| Apple | Based on our check, for any CSI subband configuration, we don’t see an issue for parameter combination 4/5/6 (and 7/8). The issue seems to exist only in parameter combination 1/2/, as shown below. There are many cases that NW can configure something that UE cannot do, such as measuring a non-active BWP or deactivated SP-CSI-RS. The handling of the specification is either to explicitly or to implicitly clarify that UE is not expected to perform the corresponding action, which we think is real missing part. |
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1. Conclusion

Based on the above inputs and discussion, the following **FL proposals** are made:

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| 1. The following is to be captured as a conclusion:    1. *There is no consensus in supporting the proposals in N.1, N.2, N.3, N.4-1a/2a/2b, N.5, N.6, and N.7 as summarized in Table 2 of [1] (R1-2003880)* 2. … |

# References

1. R1-2003880 Feature lead summary for MU-MIMO CSI Moderator (Samsung)