**3GPP TSG RAN WG1 #110 R1-220XXXX**

**Toulouse, France, August 22nd – 26th, 2022**

**Agenda item:** 7.2.6

**Source:** CATT

**Title:** Summary for R1-2206372 on LI reporting for Rel.16 Enhanced Type II CSI feedback

**Document for:** Discussion and Decision

1. Introduction

This document collects company views on a Rel.16 CR in RAN1#110 to clarify the LI reporting for Enhanced Type II CSI feedback when *reportQuantity* in *CSI-ReportConfig* contains LI parameter.

1. Summary for change

The issue is summarized in the following table:

**Table 1 Summary**

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| **The reason for CR proposal** | **Consequences if not approved** | **Summary of CR proposal** |
| In current TS 38.214, the UE shall calculate and report LI when *reportQuantity* in *CSI-ReportConfig* contains LI parameter, for all the codebook types. It is not captured in the CSI Part 2 reporting for Enhanced Type II CSI feedback in the spec. | It is unclear how to report LI when *reportQuantity* contains LI for Enhanced Type II CSI feedback. | Clarify 212 and 214 specs that CSI Part 2 for Enhanced Type II CSI feedback can contain LI if *reportQuantity* in *CSI-ReportConfig* contains LI parameter  Section 5.2.3 in 38.214 spec:  - For Enhanced Type II CSI feedback, Part 1 contains RI (if reported), CQI, and an indication of the overall number of non-zero amplitude coefficients across layers for the Enhanced Type II CSI (see Clause 5.2.2.2.5). The fields of Part 1 – RI (if reported), CQI, and the indication of the overall number of non-zero amplitude coefficients across layers – are separately encoded. Part 2 contains the PMI and LI (if reported) of the Enhanced Type II CSI. Part 1 and 2 are separately encoded.  Section 6.3.2.1.2 in 38.212 spec: (The following change is not in the original CR. It is proposed based on company comments.)  Table 6.3.2.1.2-5A: Mapping order of CSI fields of one CSI report, CSI part 2 of *codebookType=typeII-r16 or typeII-PortSelection-r16*   |  |  | | --- | --- | | CSI report number | CSI fields | | CSI report #n  CSI part 2, group 0 | Layer Indicator as in Table 6.3.2.1.2-8, if reported | | PMI fields , from left to right as in Tables 6.3.2.1.2-1A/2A, if reported | | CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A:, , and highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported | | CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported |   <Unrelated part omitted>  Table 6.3.2.1.2-8: RI ,LI and CQI of *codebookType=typeII-r16 or typeII-PortSelection-r16*   |  |  | | --- | --- | | Field | Bitwidth | | Rank Indicator |  | | Layer Indicator |  | | Wide-band CQI | 4 | | Subband differential CQI | 2 | | Indicator of the total number of non-zero coefficients summed across all layers | if max allowed rank is 1;  otherwise | |

1. Company views

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| **Company** | **Input** |
| CATT0 | **According to the FL’s assessment, this CR proposal can be treated as an editorial change.**  **Please share your views on this CR.** |
| Qualcomm | Not support. This is late change for R16 eT2 CSI feedback. Lots of IODT work have been done, and no issue is reported. This means that there might exist UEs implementing following current spec (i.e., no LI reporting for eT2 even if LI is configured in report quantity). So, accepting this change has NBC risk which affect existing UEs. Besides, 212 spec has no table for LI reporting in eT2 as well. |
| Lenovo | Although the editorial change seems fine, we understand QC’s concerns regarding NBC. Current 212 spec does not contain LI field in mapping order of CSI fields tables corresponding to eType-II and eType-II PS codebook, and hence this editorial change may require much more modifications than what appears. Further discussion is needed |
| CATT1 | We can understand the concern from QC. However, in current specs, there is no restriction on LI configuration for Rel-16 eType II. If LI is configured, according current specs, LI should be reported. But it is unclear how to report LI when *reportQuantity* contains LI. We are open to discuss the following two solutions.  •        Add the restriction on LI for Rel-16 eType II. If Rel-16 eType II codebook is configured by RRC parameter, the LI is not expected to be configured in *reportQuantity*.  •        Add the LI reporting in 214 spec and LI field in 212 tables. If *reportQuantity* contains LI for Rel-16 eType II codebook, the LI should be reported in Part 2 of CSI field. |
| Nokia/NSB | Agree with QC. LI is a wideband indicator which is mapped in the wideband part of a CSI, either Part 1 for wideband reporting on PUCCH, or Part 2-wideband for subband reporting on PUCCH/PUSCH. For R16-Type-II CBs, there is no wideband part of a CSI, so if we introduced this change, we would also need to decide which of the three priority groups LI maps to and update the tables in 212 accordingly |
| Apple | CATT raised a good issue. However, we prefer to clarify that L1 cannot be configured as part of reportQuantity, i.e., NW configures “cri-RI-PMI-CQI” instead of “cri-RI-LI-PMI-CQI” for eType II codebook. |
| CATT2 | @QC@Lenovo@Nokia: Thanks for the clarification. According to the current 212 specs, indeed, there is currently no relevant bitwidth and mapping order on LI reporting for Rel.16 eType II. Since LI is the wideband reporting quantity similar as PMI fields , the same mapping order as PMI fields can be considered, which is similar as wideband Part 2 for Rel.15 Type II. Hence, the following change for mapping order and bitwidth for Rel.16 eType II can be considered.  Table 6.3.2.1.2-5A: Mapping order of CSI fields of one CSI report, CSI part 2 of *codebookType=typeII-r16 or typeII-PortSelection-r16*   |  |  | | --- | --- | | CSI report number | CSI fields | | CSI report #n  CSI part 2, group 0 | Layer Indicator as in Table 6.3.2.1.2-8, if reported | | PMI fields , from left to right as in Tables 6.3.2.1.2-1A/2A, if reported | | CSI report #n  CSI part 2, group 1 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A:, , and highest priority bits of  highest priority bits of and highest priority bits of, in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported | | CSI report #n  CSI part 2, group 2 | The following PMI fields , from left to right, as in Tables 6.3.2.1.2-1A/2A lowest priority bits of lowest priority bits of and lowest priority bits of , in decreasing order of priority based on function defined in clause 5.2.3 of TS38.214, if reported |   Table 6.3.2.1.2-8: RI ,LI and CQI of *codebookType=typeII-r16 or typeII-PortSelection-r16*   |  |  | | --- | --- | | Field | Bitwidth | | Rank Indicator |  | | Layer Indicator |  | | Wide-band CQI | 4 | | Subband differential CQI | 2 | | Indicator of the total number of non-zero coefficients summed across all layers | if max allowed rank is 1;  otherwise |   @Apple: Thanks for provide your preference for this issue. If I understand correctly, your preference is similar as our first solution, (e.g. if Rel-16 eType II codebook is configured by RRC parameter, the LI is not expected to be configured in *reportQuantity*). We are fine to discuss the detail changes for this solution.  Other company’s input on the following issues is appreciated. Thank you. |
| Qualcomm2 | Based on the discussion in first round, there seems two alternatives   * Alt1: clarify UE is not expected to be configured with LI reporting for eT2 * Alt2: clarify the LI reporting in 212 and 214 specs when necessary   In our view, since it is quite late change for R16, the most import factor is to minimize the NBC risk. From this aspect, to address ambiguity, RAN1 should **adopt the most common and reasonable implementation** that could have been implemented in UE and gNB. Thus, we think Alt1 is safer than Alt2 and a conclusion maybe sufficient. However, we can be flexible if majority think Alt2 is the most common and reasonable implementation.  Besides, for Alt2, we should also add description for v under the table, and also change relevant text of group0 component in 214 spec. |

# References

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| 1 | [**R1-2206372**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206372.zip) | Clarification of LI reporting for Enhanced Type II CSI feedback | CATT |
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