**3****GPP TSG RAN WG1 #117 R1-** **xxxxxx**

**Fukuoka, Japan, May 20th – May 24th, 2024**

**Agenda item:** 9.1.3.2

**Source:** Moderator (Qualcomm)

**Title:** Additional study on AI/ML for NR air interface: CSI compression results template discussion

**Document for:** Discussion and Decision

# Introduction

This document is to discuss results template for Rel-19 CSI compression studies.

# General remarks

Changes in the results template spreadsheets are marked in purple.

Additions in the results template spreadsheets are marked in red.

Please provide comments in the tables provided in this document. In addition, you may add comments directly in the template spreadsheet using the MS Excel commenting tool.

# CSI\_Table X1. CSI compression temporal Case-1-2-5 1-on-1 joint training

Adopting Table 1 used in Rel-18 as starting point, the following changes were made

1. Moved common description and dataset description to the top (this is only formatting changes; there is no change in contents)
2. Merged max rank 1, 2, and 4 into one tab, similar to what was done for some spreadsheets in Rel-18 SI.
	* Using the rank-dependant α scaling for X, Y, and Z ranges
	* Introducing the rank-dependant β scaling for A, B, and C
3. Added new rows based on the Agreements
4. Note that there are two benchmark schemes: non-AI/ML baseline (e.g., eType2) and Rel-18 AI/ML baseline.
5. Some rows are not relevant to Case 1/2/5 but were added so that the same template could be used for Case 1/2/3/4/5.

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| --- | --- |
| *Company* | *Comments* |
| Huawei, HiSilicon | One question for the eventual KPI: if we have multiple results separately for Rank 1, 2, 4, do we fill the entries for eventual KPI in the following manner, or fill the results for different ranks in separate columns?

|  |  |  |
| --- | --- | --- |
| **Gain for Mean UPT (for a specific CSI feedback overhead)** | **A: <= β\*80 bitsRU<=39% / 40%-69% / >=70%** | Rank1: a1% / b1% / c1%Rank2: a2% / b2% / c2%Rank4: a3% / b3% / c3% |
| **B: β\*(100bits – 140 bits)RU<=39% / 40%-69% / >=70%** | Rank1: a1% / b1% / c1%Rank2: a2% / b2% / c2%Rank4: a3% / b3% / c3% |
| **C: >=β\*230 bitsRU<=39% / 40%-69% / >=70%** | Rank1: a1% / b1% / c1%Rank2: a2% / b2% / c2%Rank4: a3% / b3% / c3% |

 |
| Mod | Thanks Huawei/HiSilicon for raising the question. Combining rank1/2/4 into one cell will complicate it too much, so I separated rank 1/2/4 into different tabs.Please see the updated templates X1, X2, and X3. |
| Mod | Please see my comment for Case 3/4. We may need similar adjustment for Case 1/2/5. |
|  |  |

# CSI\_Table X2. CSI compression temporal Case-3-4 1-on-1 joint training

CSI\_Table 9 is similar to CSI\_Table 8 except that it has two additional rows:

1. Prediction window
2. Prediction scheme

and there is only one benchmark scheme: non-AI/ML compression (e.g., Rel-18 Doppler eType2).

Some rows are not relevant to Case 3/4 but were added so that the same template could be used for Case 1/2/3/4/5.

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| *Company* | *Comments* |
| ZTE | We have a question about the feedback overhead Z for Case 3/4. According to the note, X/Y/Z are feedback overhead rates in bits per time unit of 5ms. To our understanding, the highest parameter combination level (i.e., PC9) of Rel-18 eTypeII is less than 700 bits under Rank=1. If prediction window length is 4, the feedback overhead rate is less than 175 bits/instance, which cannot satisfy the feedback overhead Z(i.e., >=230 bits). So, we would like to know how to resolve this situation. Thanks.

|  |  |  |
| --- | --- | --- |
| **SGCS of benchmark, layer 1** | **X: <=80/α bits** | a (b bits)  |
| **Y: 100/α bits-140/α bits** | a (b bits)  |
| **Z: >=230/α bits** | a (b bits)  |

 |
| Mod | Thanks ZTE for raising this. Given the max payload size of Rel-18 eTypeII and normalization per 5msec, and given the better compression via temporal domain achieved by Case 3/4, we may want to adjust the range of X, Y, Z (and A, B, C for UPT). This could be done by either directly changing the boundary values 80, 100, 140, 230, or by changing the value of α and β. We may need the same adjustment for Case 1/2/5.I may bring proposals on this aspect. |
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|  |  |

# CSI\_Table X3. CSI compression localized model

CSI\_Table 10 is similar to CSI\_Table 8 and 9 except

1. Temporal aspects were removed
2. Global/local region assumptions were added as agreed
3. There are two gain numbers: one over non-AI/ML benchmark (within a column) and the other over the global model (across columns)
4. Added relative complexity of local model compared to global model

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| --- | --- |
| *Company* | *Comments* |
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# CSI compression temporal case with model generalization

TBD

Conclusion

For model generalization results table, adopt Rel-18 Table 2 and Generalization Case 1 / 2 / 3 as starting point with same additions above. For generalization aspects, adopt the following

* Various UE speed
* UE distribution
* Various CSI-RS periodicity

# CSI compression temporal case with model scalability

TBD

Conclusion

For model scalability results table, adopt Rel-18 Table 3 and Generalization Case 1 / 2 / 3 as starting point with same additions above. For generalization aspects, adopt the following

* Various numbers of antenna ports
* Various frequency granularity
* Various payload size

# CSI compression temporal case Multi-vendor joint training

TBD

Conclusion

For multi-vendor results table, adopt Rel-18 Table 4 for joint training and Rel-18 Table 5 for separate training as starting point, with the same additions of above 2 agreements.

# CSI compression temporal case Separate training

TBD

Conclusion

For multi-vendor results table, adopt Rel-18 Table 4 for joint training and Rel-18 Table 5 for separate training as starting point, with the same additions of above 2 agreements.