**3GPP TSG RAN WG1 #110 R1-2206783**

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

**Agenda item:** 9.1.2

**Source:** Moderator (Samsung)

**Title:** Moderator Summary of Tuesday Offline Session on Rel-18 CSI enhancements

**Document for:** Discussion and Decision

## Introduction

This contribution includes the summary for the Tuesday offline session.

## Discussion

### Issue 1: Type-II codebook refinement for CJT

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| **Proposal 1.G**: On the Type-II codebook refinement for CJT mTRP, down-select from the following TRP selection/determination schemes (where N is the number of cooperating TRPs assumed in PMI reporting):   * Alt1. N is gNB-configured via higher-layer (RRC) signalling   + The N configured TRPs are gNB-configured via higher-layer (RRC) signalling   + Note: only one transmission hypothesis is reported * Alt2. N is UE-selected and reported as a part of CSI report where N{1,..., NTRP}   + N is the number of cooperating TRPs, while NTRP is the maximum number of cooperating TRPs configured by gNB   + In this case, the selection of N out of NTRP TRPs is also reported (FFS: exact reporting scheme)   + FFS: Configuration of NTRP TRPs and the value of NTRP, whether explicit or implicit   + Note: only one transmission hypothesis is reported   + ~~FFS: In addition to one transmission hypothesis, whether reporting multiple transmission hypotheses (with the same N value or possibly different N values) is supported~~ * Alt3. The UE reports CSI corresponding to K transmission hypotheses   + The N configured TRPs per hypothesis are gNB-configured via higher-layer (RRC) signalling   + FFS: supported value(s) of K, and whether the K transmission hypotheses are gNB-configured or UE-reported   + FFS: Whether the same N value or possibly different N values * Alt4. The UE reports CSI corresponding to K transmission hypotheses where N is UE-selected and reported as a part of CSI report where N{1,..., NTRP}   + N is the number of cooperating TRPs per hypothesis, while NTRP is the maximum number of cooperating TRPs configured by gNB   + In this case, the selection of N out of NTRP TRPs is also reported (FFS: exact reporting scheme)   + FFS: Configuration of NTRP TRPs and the value of NTRP, whether explicit or implicit   + FFS: Whether the same N value or possibly different N values   FFS: Whether S-TRP transmission hypothesis is also reported  **Alt1:** Samsung, Huawei/HiSi, Xiaomi, CMCC, AT&T, Nokia/NSB, DOCOMO, Google, Fraunhofer IIS/HHI  **Alt2:** ZTE, Spreadtrum, vivo (one hypothesis), NEC, Xiaomi, CEWiT, Ericsson (one hypothesis), Sony, MediaTek, LG, CATT, Qualcomm, Apple, Intel, OPPO  **Alt3:** IDC, Lenovo, Xiaomi   * Concern (overhead, UE complexity): Nokia/NSB, Samsung, MediaTek, AT&T, vivo, DOCOMO, Spreadtrum, Intel, CEWiT, Huawei/HiSi, Ericsson   **Alt4**: Sony, ZTE, CATT   * Concern (overhead, UE complexity): Nokia/NSB, Samsung, MediaTek, AT&T, vivo, DOCOMO, Spreadtrum, Intel, CEWiT, Huawei/HiSi, Ericsson |

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| **Proposal 1.I**: On the Type-II codebook refinement for CJT mTRP, regarding W2 quantization group and Strongest Coefficient Indicator (SCI) design, for each layer, down-select from the following alternatives:   * Alt1. One group comprises one polarization across all TRPs/TRP-groups (*C*group,phase=1, *C*group,amp=2), one (common) SCI across all TRPs/TRP groups   + Without the strongest TRP/TRP-group indicator * Alt2. One group comprises one polarization for one TRP/TRP-group (*C*group,phase=N, *C*group,amp=2N), per-TRP/TRP-group SCI   + With the strongest TRP/TRP-group indicator   + FFS: Quantization of N strongest coefficients * Alt3. One group comprises one polarization for one TRP/TRP-group with a common phase reference across TRPs/TRP-groups (*C*group,phase=1, *C*group,amp=2N), per-TRP/TRP-group SCI   + With the strongest TRP/TRP-group indicator   + FFS: Quantization of N strongest coefficients |

### Issue 2: Type-II codebook refinement for high/medium UE velocities (with time/Doppler-domain compression)

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| * On the definition of UE-side prediction, down-select from the following alternatives:   + Alt1. UE “predicting” channel/CSI after the slot with a reference resource   + Alt2. UE “predicting” channel/CSI after slot n (where the CSI is reported)   + Alt3. UE “predicting” channel/CSI after the slot where CSI-RS resides   **Alt1:** Qualcomm, Samsung, LG, ZTE, Fraunhofer IIS/HHI, DOCOMO  **Alt2:** Huawei/HiSi, vivo, Nokia/NSB (2nd pref), Lenovo, Google, Intel**,** MediaTek, Ericsson, Spreadtrum, CATT, CMCC, Apple  **Alt3:** Samsung, DOCOMO, NEC, Nokia/NSB (1st pref) |

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| **Proposal 2.F**: On the CSI reporting and measurement for the Rel-18 Type-II codebook refinement for high/medium velocities, when UE-side prediction is assumed, down-select ~~at least~~ one from the following alternatives:   * ~~Alt1.A:~~ *~~l~~* ~~+~~ *~~W~~*~~CSI~~ ~~–1 ≤~~ *~~n~~*~~ref~~   + *~~n~~*~~ref~~ ~~(CSI reference resource slot) as boundary~~ * Alt1.B:  *l* ≥ *n*ref   + *n*ref (CSI reference resource slot) as boundary * Alt2.B: *l* ≥ *n*   + *n* (report slot) as boundary * Alt3.B: *l* ≥ *k* + *W*meas –1   + End slot of *W*meas (*k* + *W*meas –1) as boundary, assuming CSI-RS measurement window of [*k*,*k*+*W*meas –1]   Alt1.B:  Alt2.B:  Alt3.B:  [Alt3.C: *l* < *k* + *W*meas –1 and *l* + *W*CSI –1 > *k* + *W*meas –1 with the following as special cases:   * + *l=k,* *l* + *W*CSI = *n*   + *l=k,* *l* + *W*CSI > *n*]   Support: Samsung, Qualcomm, Fraunhofer IIS/HHI  Concern: vivo, MediaTek, Xiaomi, Spreadtrum |

### Issue 3: TRS-based reporting of time-domain channel properties (TDCP)

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| **Proposal 3.B**: For the Rel-18 TRS-based TDCP reporting, down select one of the following alternatives by RAN1#110bis-e:   * AltA. Based on Doppler profile   + E.g., Doppler spread derived from the 2nd moment of Doppler power spectrum, average Doppler shifts, Doppler shift per resource, maximum Doppler shift, relative Doppler shift, etc. * AltB. Based on time-domain correlation profile   + E.g. correlation within one TRS resource, correlation across multiple TRS resources   + Note: the correlation over one or more lags of TRS resource may be considered. The lags may be within one TRS burst or different TRS bursts * AltC: CSI-RS resource and/or CSI reporting setting configuration parameter(s) to assist network |